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THE ELECTRIC LIGHT CONVENTION.

Chicago has many advantages as a convention city, and to this may be attributed in some degree the great success of the meeting of the National Electric Light Association last week, with 2000 persons in attendance. Large as such a gathering seems, it might well have been larger, and is in a sense symptomatic of the magnitude of the industry. How much larger it might be is indicated by the simple fact that Illinois alone has over 400 systems, a large proportion of which are entitled to membership; yet we doubt very much whether 50 Illinois companies had any representation. If the total number of central station systems eligible for active or Class A membership be taken into account, it will be seen that the association, vigorous and growing as it undoubtedly is, has still plenty of room for expansion. It is this situation that gives special interest at this time to the Doherty scheme of federation and of increasing the area of contact. This plan, noted elsewhere, has some elements of doubtful value, but it is certainly well worth trying on its merits. What Mr. Doherty is aiming at is the welfare and participation of the smaller companies, whose inertia and apathy it is so difficult to overcome, yet who are after all the chief beneficiaries of association work. They need the association just as much as the association needs them as factors in the exertion of its influence; and their accession will help in many directions. The main difficulty with regard to "sections" is keeping them alive. If they have not sufficient vitality from within, none that the central body can supply will prevent them from falling into a moribund state, as the American Institute of Electrical Engineers has found out.

Besides gaining new member companies, it is important that the association, or any such body, should constantly import young and coming men into its inner circle of authority. This is only another means to maintenance of health. It prevents the formation of cliques and "rings," which, wholly honest and public-spirited, can believe only in the merit of things done in one way and which are usually averse to novelty and experiment. The association again is fortunate in this respect. The retiring president and secretary are both young men; the incoming president and secretary are, if anything, even younger; while the other officers, including the executive committee, are nearly all new men, unhampered by prejudices and limited only by the good traditions of past management that explain the excellent repute and high standard of this national body—as great a force in electrical industry as the Institute is in electrical engineering.

The Street Railway Association has worked out its salvation by having affiliated bodies that conduct meetings and discussions. The Electric Light Association is now trying the plan of two or three sessions at once "in parallel," but looks askance at any scheme which would tend to split it up centrifugally. The officers believe that the members can sift themselves apart automatically for such sessions, yet come together again as a related and integral whole for any joint debate or discussion

necessary. The double sessions last week were successful, and will probably be repeated with evolutional improvements. Such profusion of work adds of course to the bulk of the transactions, but it is neither desirable nor necessary that every word should be printed. A paper or a remark does not gain in value or permanence of interest merely because it is delivered in conversation, and thinking out aloud will stand lots of editing.

Protection from Lightning During the Year 1907-1908.

An interesting and useful report of the committee of the National Electric Light Association on protection from lightning was read at the recent convention in Chicago. The report contains data derived from nearly 200 operating companies, whose transformers aggregated nearly three-quarters of a million kilowatts. The committee has carried on its investigations from the preceding year, so that the statistical form of the report has the advantage of being the same as that made a year ago. The two successive annual reports show that there has not been much change in respect to damage from lightning. In 1907 there were 3.2 interruptions per annum per company and in 1908 there were 3.18. In 1907 there was one injury to apparatus for every 166 kw capacity installed and reporting. In 1908, there was one such injury to every 188 kw capacity installed. There were fewer transformers but more meters injured during the latter year. The number of poles split was more than doubled in the latter year, one particular company having had very bad luck with its pole line. Meteorological statistics as to the relative frequency of thunderstorms in the two years compared do not appear to have been obtained from the Weather Bureau.

Specifications for Street Lighting.

At the recent convention of the National Electric Light Association in Chicago, the final report of the committee of 1907, to consider specifications for street lighting, was presented by Mr. W. D'A. Ryan, in a paper which condenses the results of 15,000 photometric observations. These observations were mostly carried out in the streets of United States cities with a form of portable photometer. The photometer was set up on a tripod in the street 250 ft. away from the street arc lamp under test. The value of this final report lies in the practical nature of its observations and in their great extensiveness. It cannot be said in future that information has not been placed at the disposition of the members of the association as to the actual behavior of arc lamps on city streets. In the early days of electric arc-lighting, photometry was in a very undeveloped state. It is difficult to measure arc-lamps with precision to-day, in spite of greatly increased facilities and experience. It was doubly difficult to do so at that time. The lack of agreement between the measurements of different observers left a vacancy for imagination to supply, and because a certain type of open arc lamp was found occasionally to approach 2000 candles in the most favored direction, with the best of attention in the laboratory, it was unfortunately named and classified industrially as a 2000-cp lamp.

A committee of experts considered this matter in 1894 and reported at that date to the association that it was hopeless to test arc-lamps of this character by photometer. They realized that if lamps were tested in the street for candle-power, according to specifications, that no two measurements would be likely to agree, and that probably few would come up to 2000 cp under practical conditions. They therefore defined a 2000-cp open arc lamp as one which consumed 450 watts at terminals, with no sensible resistance in series with the arc. This was like defining the speed of a horse in terms of the amount of hay it consumed daily; but it was really the most sensible resolution to adopt under the existing conditions. It defined the amount of power that the central station should supply to its series lamps, and if these were properly trimmed, with ordinarily good carbons, it was left to be inferred that the arc lamp would do the rest. As a matter of fact, such arc lamps commonly gave about 1300 cp in the most favored zone, which was depressed about 50 deg. below the horizon, and in the horizontal direction along the street they only gave about 350 cp. They poured light into a ring almost immediately underneath them, for the benefit of casual insectivorous toads, but they were very weak in the direction along the street where the light was most needed by pedestrians, equestrians or drivers.

The 450-watt rating served satisfactorily for about 15 years, and then troubles began, owing to the activities of inventors who produced arc lamps capable of emitting more candle-power horizontally along the street than the 450-watt carbon arc, and which also required less power to operate them. Here was an advantage alike to the citizen and to the power-station, but it upset the good old 450-watt rule. What was the use of adhering to a rule that a 2000-cp arc lamp was one which consumed 450 watts or six-tenths of a horse-power, if a new lamp gave a better light down the street where it was needed and yet only took 300 watts? This opened up the whole question of street photometry, and forced the problem of such photometry into practical consideration. A committee was appointed by the association in 1906 to reconsider the question. By that time there were a number of different types of street arc lamps in competition. The committee recommended that the candle-power rating of such lamps should be abandoned, and replaced by a rating in terms of normal illumination at a distance along the street of from 200 ft. to 300 ft. from beneath the lamp. This was a desirable and an expedient change, in order to get away from invidious comparisons with the 2000-cp. arc lamp called for in many old contracts. But it was really chasing a devil around a stump, because a defined illumination at a definite distance is equivalent to an inferred candle-power in that particular direction; so that the candle-power definition is only hidden from view as an ostrich hides its head in the sand to escape observation.

The observations reported in the excellent and laboriously prepared report to the Chicago convention show that the normal illumination at 250 ft. from beneath the lamp tested reached as much as 0.012 foot-candle in particular tests of the magnetite lamp, corresponding to 750 candles in the lamp, down to as low as 0.002 foot-candle in particular tests of the 9.6-amp direct-current series open arc-lamps corresponding to 125 candles—the same type of lamp that had an original rating of 2000. The average values reported were, however, equivalent to 575 cp for the magnetite lamp, 400 cp for the 6.6-amp direct-current series enclosed carbon lamp, and 256 cp for the 6.6-amp direct-current series open carbon lamp. The X-ratings proposed in terms of illumination appear to be conservative and satisfactory, so that in view of this report the committee and the association are to be congratulated upon the resolutions adopted for future street-lighting specifications. The moral of the whole story as it has developed itself historically, is the great industrial im-

portance of development in applied science. Had arc-light photometry been developed in 1875 and 1880 to a higher stage than the relatively crude condition then attained, arc-light installers and users would not have named the lamps then used lamps of 2000 cp, when actually in the horizontal direction they only gave less than a quarter of that intensity. The error thus fallen into has gone on adding inconsistency to misconception until even to-day we have not emerged from the confusion.

The Air-Gap Correction Coefficient.

The last number of the *Journal* of the British Institution of Electrical Engineers contains an original communication by Mr. P. H. Powell upon the correction which should be applied to the apparent area of a dynamo air-gap, when the rotor is slotted, and the teeth project over the slots to a greater or less extent, as is usually the case. The problem may be alternatively presented by inquiring what magnetic flux gets into the rotor through the spaces between the teeth in addition to the flux which passes across the air-gaps into the external surfaces of the teeth. The method of inquiry pursued was hydrodynamical. That is, two glass plates were set parallel to each other, so as to form two walls of a box. The space inside the box was occupied by a wax model of the iron parts, occupying half of one tooth pitch, and a number of jets of liquid were forced through the box in such a manner that their forms could be examined and photographed. It is known that the forms of these liquid jets correspond to those of the invisible flux lines in the iron and air around a polar tooth, assuming that the iron is far from being completely saturated. The photographs, which present beautiful liquid contours, indicate that if the teeth are not highly saturated they shield the slots magnetically to a very considerable extent, except, of course, when very broad slots exist. Only a comparatively few flux lines lose their way into the interior of the slots and terminate on the walls or floors of these slots. The corresponding numerical correction factors are given for about 30 different ratios between the tooth pitch and other geometrical factors. For the ratios that occur more commonly in practice, the correction factor averages about 15 per cent. It must be remembered, however, that it is common practice to attain a very high magnetic density in the teeth, and this will tend to throw more flux into the passageways between them and so increase the correction factor.

The method used requires considerable experimental skill, but has the advantage of presenting the outlines of the inferred flux paths directly before the eye. It makes the invisible visible by analogy. Even if the method is limited insofar as relates to the question of magnetic saturation in the iron, it offers a delightful experimental method of displaying the outlines of magnetic flux paths, under complex geometrical conditions, to a large audience. One of the experimental difficulties referred to in the communication is the prevention of air bubbles from being formed in the castings of the wax layers. The method resorted to is described as having been the mechanical agitation of the apparatus during the period of casting by causing an electric bell to vibrate and hammer the dish containing the wax and glass plate during the period of casting. A preceding research has already been published, in the same journal, for the cases of teeth without projections over the intervening slots, i. e., simple rectangular teeth and simple rectangular slots. The research lately published, therefore, completes the series. The previously published research gave results that admitted of being checked mathematically and seemed to sustain the check satisfactorily. This time our present condition of mathematical analysis gives up the attempt.

Electrical Inspection.

The subject of proper inspection of interior wiring in small towns was thoroughly gone over at the recent Nebraska Electrical Association Convention. There were no dissenters from the opinion that poor interior wiring is inimical to the central-station industry. It was admitted that whatever advantage might be gained by cheap, shoddy work, such as an increase of the company's connected load by virtue of the low price charged the consumer for this kind of work, it is a questionable advantage which will ultimately injure the business. To the question of how best to secure proper inspection of interior wiring neither the central-station men, the representative of the underwriters nor the city electrical inspector, who took part in the discussion, had any very satisfactory answers to offer. Inspection involving fire risks primarily lies with the insurance companies, owing to their financial interest. It is, however, a well-known fact that insurance companies have in the main attempted to evade this expense by securing city electrical inspection in the larger cities. There is, of course, an element of justice in having this done by a city, just as it is proper that a city should tax itself for the maintenance of a fire department. In large cities the matter of expense of inspection is not as serious as it is in the small towns. In the latter there are several methods of securing wiring inspection and protecting consumers and the general public. One is for the insurance companies to send inspectors—a plan which has never, so far as we know, been worked with any satisfaction because of the expense involved in sending competent inspectors at the proper time. To reduce expense, various makeshifts have been resorted to, such as assigning to one man inspection of everything entering into a risk, including the electrical part of the work, or having the chief or some other officer of the fire department educate himself for an inspector of electrical wiring.

The central-station company in the small town is usually the most competent to conduct electrical inspection, and also should have a direct interest in seeing that good work is done. As a matter of fact, it is practically up to the central-station company to do what inspecting is done in most small towns at the present time, and it is likely that this will be the condition of affairs for some time to come. The plan is open to only two real objections. One of these is that the company is itself a wiring contractor bidding for work along with other wiring contractors, and might therefore be considered a prejudiced judge of what constitutes good work. The other objection is that sometimes the central-station company fears to condemn bad work because of offending a prospective consumer. The latter objection, however, can be largely overcome by diplomatic handling of any case and by explaining to a consumer that whatever ruling against bad work is made is in the interest of the consumer's safety and the general reputation of electric service, and that the company has everything to gain by getting the consumer connected rather than by refusing to connect until the wiring is properly installed. It is certain that the small central-station company which refuses to encourage good wiring and which gives service to a lot of buildings which never should have been connected, is inviting trouble for the future.

Boston Edison Company to Supply Tungsten Lamps.

In line with the recent action of the New York and Brooklyn Edison Companies the Edison Company of Boston has issued to its customers a circular announcing that tantalum tungsten lamps will be made available to its consumers. The circular sets forth the advantages in efficiency and economy of the new lamps over the old lamps which have been in general use by electric light companies for the last 20 years. Referring to life, the circular states that the life of the carbon lamp averages 400 hours, while that of the tungsten is about 1000 hours and of the tantalum, 750 hours.

Electrical Manufacturers' Club Meets at Hot Springs, Va.

Twenty-two members of the Electrical Manufacturers' Club, representing large electrical manufacturing interests, met at Hot Springs, Va., from May 14 to May 18, for the semi-annual gathering of the organization. Twice a year the members come together to discuss general conditions, compare notes and to enjoy the relaxation from business routine which such an outing affords, the object of the organization being to enable the men in the same lines of electrical business to meet one another socially as well as in business life. There was no set program, the members driving, playing golf or indulging in other recreations according to their tastes, meeting each night about one large table at dinner to talk over the general electrical situation. The concensus of opinion was that the electrical business will begin to show symptoms of the activity of a year ago as soon as the presidential nominations are decided. All the representatives agreed that the business of each month since the beginning of the year has shown an improvement over the business of the preceding month. The officers of the association are: Mr. George A. Cragin, of the American Steel & Wire Company, president; Mr. H. T. Paiste, of the Paiste Company, vice-president; Mr. B. M. Downs, of the Brookfield Glass Company, secretary; Mr. J. H. Mason, of the Simplex Wire Company, treasurer. The annual meeting will be held at Hot Sprngs, Va., in October.

Improvement of New York Subway.

Mr. Bion J. Arnold has submitted his fourth report on the New York Subway to the Public Service Commission of the First District of the State of New York. This report, which is entitled "The Capacity of the Subway," analyzes the fundamental design of the subway, points out how further increase in its capacity can be obtained, and directs attention to certain defects or omissions in the present arrangement that should be avoided in future subways. He stated that the capacity of the present subway, as now operated, can be increased fully 60 per cent, and possibly 75 per cent, without greatly changing its construction; that it will be possible to construct new subways with a capacity from two to three times as great as that now being realized with the present subway, and that the operating expenses and fixed charges for future subways can be reduced to an amount that will make it possible not only to produce a satisfactory return on the investment, but also to set aside a fair amount each year to take care of depreciation.

Mr. Arnold recommends an increase in the number of tracks at Ninety-sixth Street, where the greatest amount of congestion takes place, in order that the four tracks upon the present level may be used exclusively by the express trains. Considerable improvement can be made by running longer trains. The number of cars on local trains should be increased from five to seven, and on express trains from eight to ten. By running these trains at the rate of 40 per hour on each track instead of the present 30, the carrying capacity of the present subway will be increased by 75 per cent.

City Lighting in Boston.

There is no longer much likelihood that the city of Boston will install a municipal lighting plant for the electric lighting of the City Hall, the old Court House and the old Probate Building, the group of buildings on Court Square where municipal departments now have complete occupancy. Mayor Hibbard gave some attention to this scheme when he first came into office, and was inclined to regard it with considerable favor, believing that with the boiler and heating plant necessarily required for these buildings, the electricity could be developed by the city with comparatively slight expense. Removal of restrictions formerly preventing the wire connections under or over the streets also invited attention to the project. But the Mayor is earnestly working for economy, and the complications are now such that the installation is, for the present, practically abandoned, awaiting the general recommendations of the finance commission as to municipal lighting. Meanwhile, one move toward economy has been the consolidation of the lamp department with the street department, displacing Superintendent of Lamps D. J. Hern and placing his department in charge of Superintendent of Streets Guy C. Emerson, a graduate of the Massachusetts Institute of Technology, whose first prominence as an engineer in Boston was in connection with the construction of the first subway by the transit commission. Superintendent Hern's last report, issued recently, shows that all kinds of lamps increased in number in Boston from January, 1907, to January, 1908, excepting double-mantle naphtha and Welsbach naphtha. The figures are:

	Jan., 1908.	Jan., 1907.	Incr'se.
Welsbach gas	10,685	10,071	614
Welsbach naphtha	1,446	1,791	—345
Electric arc	3,796	3,784	12
Electric incandescent	41	32	9
Fire alarm	188	179	9
Triple-mantle gas	180	175	5
Triple-mantle police	19	...	19
Double-mantle naphtha	16	21	—5
Total	16,371	16,053	318

It is regarded as hardly likely that legislation to apply the sliding-scale principle generally among Massachusetts lighting companies will be passed by the present Legislature. It looks rather as if the subject would be delegated to a special recess committee of the Legislature, or possibly to the gas and electric-light commission, with two special commissioners added, with instructions to report to the next Legislature.

There are numerous influential citizens in Massachusetts, particularly in Boston, who have great faith in the sliding-scale principle of regulating the price of gas; and the experience of the Boston Consolidated Gas Company has been such as to suggest popular favor for the scheme as applied to smaller companies throughout the State. But when the companies presented a draft of a sliding-scale bill the other day that would meet the situation satisfactorily to them, these citizens and the Public Franchise League balked, claiming that the bill meant a recapitalization of the companies, and began to argue for more time for legislative discussion before any final action should be taken.

Now that Boston's famous finance commission, in conducting its investigations looking to greater municipal economy, has turned its attention to the lighting of the city it is expected that the forthcoming report of Commissioner George U. Crocker, former city treasurer, who has recently returned from a month's tour of important European cities, may prove of considerable interest. Mr. Crocker inquired into cost and methods of lighting in London, Paris, Berlin, Vienna and Budapest, and he is expected to hand in figures on which some comparison may be made of lighting costs and efficiency in Boston as compared with foreign centers. Just now he is finding it a considerable task to reduce a mass of information based on the metric system to the system employed in this country. So far he has given no expression of his impressions and findings other than to cite the extensive use of the electric flaming arc in Europe. Boston has already experimented with the latter, but not in any general way.

Annual Meeting of the A. I. E. E.

At the meeting of the American Institute of Electrical Engineers held on May 19, it was announced that the following officers had been elected: President, Mr. L. A. Ferguson; vice-presidents, Messrs. C. C. Chesney, Calvert Tounley and B. Gherardi; managers, Messrs. D. B. Rushmore, H. E. Clifford, C. W. Stone and W. G. Carlton; treasurer, Mr. Geo. A. Hamilton; secretary, Mr. Ralph W. Pope.

President H. G. Stott stated that at the Washington conference on the conservation of the natural resources of the country, which had been called by the President of the United States, the four presidents of the national engineering societies, namely, electrical, civil, mechanical and mining, drafted a set of resolutions for presentation to the conference. These resolutions recommended the appointment by the various States of technical commissions to investigate the conditions in each State, and also of a national commission, the commissions to be composed of representative men of the highest character, and also that another conference be called when the commissions were ready to report. The resolutions adopted at the conference were based on the above resolutions submitted, though reported in somewhat different form.

Machinery Club Opening.

With approximately 3000 members and guests present, the Machinery Club of New York, on the afternoon of May 21, formally began its existence in its rooms on the two top floors in the Fulton Building, at 50 Church Street. Before the club opened its membership numbered 1100, many of whom represent various electrical interests in New York and other parts of the country. All the rooms were ready for inspection at 1 o'clock and a reception committee of 96 members was on hand to receive the members and their friends. The prevailing, genial "holiday spirit" which was omnipresent made the opening a great success and augurs well for the future popularity of the organization. The main dining room, seating 500 persons, was decorated with carnations and festoons of greenery, and in the center of the room an orchestra of 10 pieces was stationed. An elaborate buffet lunch was served, not only in the main dining hall, but also in the grill room, the ladies' dining room and the private dining rooms. The success of the club is no longer in question; in fact, it was assured before the doors were opened. It has members in 127 cities and in Mexico, Cuba, Japan and some of the cities of Europe. As time elapses the Machinery Club undoubtedly will become one of the most powerful and popular of the down-town organizations. Formal exercises were omitted, the only feature of the occasion being a speech of welcome by Mr. George A. Post, of the Standard Coupler Company. Mr. Post is one of the governors of the club and also serves on the executive committee.

Introduction of Tungsten Lamp in New York City.

The subject of the effect with respect to customer's bill, of the introduction in New York City of the tungsten lamp, came up for discussion at a meeting on May 20 of the Public Service Commission of the First District. Mr. John W. Lieb submitted for the New York Edison Company tabulations giving the saving to customers from the use of the tungsten lamp.

One table was based on the supposition that the customer is entitled to free lamp renewals under the contract, and shows that for each unit cost at the present rate, the effect of the reduced current consumption is equivalent to a reduction in the rate itself of 60 per cent. Another table shows that, at the rate of 10 cents per kw-hour, including lamp renewals, or at the rate of 9½ cents per kw-hour, assuming that he gets a discount of one cent for making his own renewals, and again assuming that these renewals would cost him one-half a cent, his saving would be 49.05 per cent over the use of the carbon lamp. Mr. Lieb concluded that no consumer of the Edison Company would ever be required to pay more if he used the tungsten lamps than he would when using the carbon filament lamps, assuming that the amount of illumination is the same in each case. The tendency of the introduction of the tungsten lamp is to equalize the rates between the small and the large consumers, providing there is no conflicting contract stipulations.

Mr. Frank W. Smith, of the United Electric Light & Power Company, Mr. Walter F. Wells and Mr. C. G. M. Thomas testifield in reference to their respective companies, that in certain cases some consumers might, by the use of tungsten lamps, be required to pay more per unit for current, but in no case would he pay more for the total illumination.

Meeting of Cleveland A. I. E. E. Section.

At a meeting of the American Institute of Electrical Engineers, held in the rooms of the Civil Engineers' Club in the Caxton Building on May 18, Dr. C. P. Steinmetz delivered an address on the progress of improvements in electrical devices and equipment during recent years. The talk was a very interesting one and was listened to by the largest number of engineers that have yet attended any of the meetings. Dr. Steinmetz said that the financial depression had caused a temporary suspension of active business and had given the engineers an opportunity to push development in various directions and complete, to some extent at least, those things which had been in an imperfect condition for some time. More has been done within the past year in this line than ever before in the same time.

He referred to the development of the tantalum and tungsten lamps, which are close competitors of the arc lamp in efficiency. The development of the lamp has required much money and this is still a large factor in the cost of the lamps and will be until they are brought to a manufacturing status somewhere near that of the carbon filament lamp. The first tungsten lamps were very delicate and had to be used in a vertical position. Improvements have been made in this filament until it is now quite strong, and it is believed that eventually it will be equal in this respect to the carbon filament.

Dr. Steinmetz talked at some length on alternating series commutating pole motors and explained the advantages in their use in car operation. He said that engineers had been able to secure a very much increased power through perfect control of the magnetic flux and that good commutation had been secured by the introduction of the commutating field. He explained that severe sparking for a few seconds did no damage and that sparking had been almost entirely eliminated.

Another subject that was treated of quite extensively concerned lightning and the protection of electrical systems by the use of arresters of the types perfected only very recently. They are of such a character that they form little resistance to discharges of high voltage but prevent the machine current from following. Aluminum plates in the arresters act as a resistance up to certain voltages, when the counter e.m.f. becomes such that the current of higher voltage will flow across the plate as if there was no resistance in the line, but the machine current, being lower, does not follow. Dr. Steinmetz explained a number of experiments made on transmission lines in Colorado and discussed the subject in a most interesting manner. He spoke briefly of steam economy and compared the turbine and reciprocating engines along this line.

After the completion of his address, Dr. Steinmetz was asked to discuss the development of the luminous arc and its application to lighting. He said that the mercury rectifier, formerly very delicate, had been improved until it is now fairly durable. The time will come when its lasting qualities will be almost indefinite. He spoke of one rectifier that had been used for 15,000 hours under his observation, and said that it was as good now as at first. In order to prevent injury to the rectifier, care should be taken in starting up, and at first the current should

be confined either to a light or no load. Care should also be taken to prevent the arc from jumping backward, as this destroys the vacuum. Occasionally the glass will break from different causes, but on thoroughly understanding the instrument this can usually be avoided.

The officers chosen for the ensuing year are as follows: Chairman, Mr. C. E. Ricker; secretary-treasurer, Mr. F. M. Hibben. Board of managers: Prof. H. B. Dates, H. L. Wallau and George B. Dusenberrie. The next meeting will not be until the third Monday in September.

Electrical Show at Grand Rapids, Mich.

By Lewis W. Bailey.

Grand Rapids, Mich., has demonstrated the possibilities of an electrical show in a city of 100,000 inhabitants, and the results are satisfactory to the exhibitors, though the attendance was limited by the rains that prevailed throughout the week.

The exposition, which was arranged as an educational exhibit, was conducted by the Electrical Show Association, organized for the purpose, and it is the first show of the kind to be held in Michigan. Mr. M. B. Wheeler, of the Wheeler Electric Company, is president of the association, and Mr. William J. Fenton is secretary. Floor space to the amount of 15,000 square feet in the furniture exposition building was leased for the occasion and space allotted to 35 principal exhibitors, representing nearly one hundred electrical manufacturers and power companies. The show was open from 10 o'clock in the morning until 11 o'clock at night, and a good orchestra was present to supplement the work of the electrical pianos, the motor horns and the sparking of the wireless telegraph apparatus. An admission fee of 25 cents was charged and special tickets were issued for school children, admitting them for 10 cents. Parties of pupils were organized to visit the exposition and report what they saw to their schools.

A great electric sign hung across Monroe Street, a lane of incandescents bordered Ottawa Street to the exposition building, and another brilliant sign across the street in front of the entrance marked the way to the show. Inside, myriads of lights were strung in festoons from the ceiling, illuminated the booths and electrical signs flashed on every side. Gay buntings hung from pillars and draped over dividing walls added to the attractiveness of the scene.

The most elaborate of the exhibits was that of the Grand Rapids-Muskegon Power Company. It consisted of a miniature seven-room cottage, attractively furnished, thanks to Grand Rapids furniture dealers and decorators. In a mahogany furnished parlor an electric grate, equipped with luminous radiators, provided heat, an electric piano played catchy airs, pretty lamps lighted the room, and even an electric corn popper for the children and a cigar lighter for the father were supposed to add to the comforts. The dining room, equally as well furnished, contained chafing dish, coffee percolator, bread toaster and other ingenious devices. Bedrooms equipped with massage apparatus, hair dryers, electrically heated shaving mug and curling irons were open to inspection, while in the bathroom was a water heater. The kitchen contained the electric stove, fitted with switches which turned the current on the various cooking devices located on a convenient kitchen cabinet. An electrically operated dish washer, motor-driven washing machine, air-cleaning device for carpets and rugs and a refrigerator with an artificial ice-making machine electrically driven, added to the convenience of the place. The motor-driven sewing machine and the ever-handy telephone were not lacking.

A Clarke wireless telegraph station was a part of the exhibit of the M. B. Wheeler Company, which also had an attractive electrical fountain as a center piece. The Grand Rapids Railway Company fitted up a rest room, in the center of which was exhibited a model street car fender and a Brill truck. A section of Shanghai rail, laid as in the street, was so arranged as to show a cross section through a glass plate. Other street car novelties were arranged in the booth, and a series of pictures of the company's two resorts, North Park and Ramona.

The Citizens' Telephone Company demonstrated a section of its automatic switchboard. The Lewis Electric Company and the Neumann Sign Company had some striking lighting effects. The latter displayed the inner workings of the motors and machinery which keep the flash signs in operation. An exhibit of especial interest in Grand Rapids, where floods are an annual occurrence, was the seepage pump of Erwin & Company, of Chicago, which pumps the water from a wet basin and stops when the basement is emptied. Everywhere the effort was made to interest consumers or prospective users of electricity in the devices and supplies on exhibition, and that the efforts were not unavailing is shown in that talk of next year's show has already begun among the promoters and exhibitors.

Boston Branch Meeting, American Institute of Electrical Engineers.

The regular monthly meeting of the Boston Branch of the American Institute of Electrical Engineers was held at the Edison Building, on May 20, Prof. Puffer being in the chair. Papers on "Lightning Protection" were read by Messrs. J. F. Vaughan and W. J. Neall.

In the discussion which followed, Prof. Puffer raised the issue of special devices being needed on the ground connection to enable direct lightning strokes to pass downward through the overhead grounded wire and to fan out in the earth. Mr. Neall replied that the construction work done with overhead ground wires, arrester, spark-gap and tell-tale papers, was very carefully carried out to avoid any discrepancy in interpretation, and stated that investigations of poles splintered by lightning discharges showed that in every case the pole below the surface of the earth was intact.

Prof. D. C. Jackson stated that his former skepticism in regard to the value of the overhead grounded wire had been dispelled by the results on the Taylors Falls line, as described in Mr. Vaughan's paper, and congratulated the institute upon such definite studies of these phenomena.

Prof. Hooper, of Tufts College, emphasized the desirability of grounding the overhead wire at every pole. Low impedance in the ground is rather more desirable than very low resistance as measured by a Wheatstone bridge. He cited the use of a galvanized-steel overhead grounded cable on a new line built for 88,000 volts for the transmission of electrical energy into Rio Janeiro, Brazil. During the past season many unusually severe lightning storms have been experienced, but not an insulator was lost or the service interrupted. The insulators are 18 in. in diameter and 18 in. high, and the full line voltage has not yet been applied. The only argument against the overhead wire seems to be the power lost in it, and investigations of this are desirable. Protection along the entire length of the line should be installed.

Mr. Vaughan stated that copper was used as the overhead ground lead on the Taylors Falls line in order to make the construction consistent throughout in durability and reliability. On account of the lower first cost in a Southern case, where the line could be more readily shut down for repairs, steel was recommended. Mr. M. V. Ayres suggested that the presence of direct-current feeders and other low-tension wires on the same poles with his 13,000-volt line, but beneath the latter, exercised a shielding effect in lightning protection. He could recollect but one case of insulator puncture positively caused by lightning during five summers in 30 miles of three-phase, 13,000-volt line operation. Prof. Puffer urged the importance of finding out more clearly just how the lightning stroke is distributed in the earth in the vicinity of the ground wires, and Mr. Vaughan stated that, in his practice, nests of distributed pipes are being recommended in the construction of station grounds.

Prior to the reading of the papers, the following officers were elected: Chairman, Prof. A. E. Kennelly; vice-chairman, Prof. D. C. Jackson; secretary-treasurer, Mr. A. L. Pearson; executive committee, Messrs. J. W. Corning, G. S. Gibbs, G. C. Shood, J. F. Vaughan and J. B. Wiard.

Toronto A. I. E. E. Section.

At the annual meeting of the Toronto section of the American Institute of Electrical Engineers, held May 15, Secretary W. G. Chace reported that eight meetings have been held this season, as follows: An inaugural meeting in October, one each in November, January, February, April and May, and two in March. Two meetings, the fourth and sixth, were addressed by visiting members of the institute, Messrs. Moody and Rushmore, and four meetings by members of the section. Only once were the New York papers made use of during the winter.

The attendance at the meetings has averaged between 30 and 40. The expenses have aggregated $130.65. The following officers were elected for the ensuing year: Chairman, Mr. W. A. Bucke; vice-chairman, Mr. H. W. Price; secretary, Mr. W. G. Chace; executive committee, Messrs. E. Richards, W. H. Eisenbois and R. J. Clark.

Sliding Scale System of Lighting Prices.

Before the Massachusetts legislative committee on public lighting, Mr. J. E. Pillsbury, counsel for the Massachusetts Gas Companies, argued last week in favor of a new bill for a sliding scale system for the regulation of prices and dividends of gas and electric companies. The bill provides that the standard rate of dividend for every company accepting the act shall be 6 per cent per annum and the standard price for gas the maximum price charged for the year preceding such acceptance shall not exceed $1.20 per 1000 cubic feet. The bill provides that no company accepting the act shall pay dividends in excess of the standard rate except that if during the year ending June 30 the maximum net price per 1000 cubic feet has been less than the standard price fixed for the company, it may during the following year pay dividends exceeding the standard rate in the ratio of one-fifth of 1 per cent for every one cent of reduction below the standard price. Dividends shall be reduced vice versa according to price. Existing indebtedness shall be deducted from valuation, but without prejudice to right to capitalize such indebtedness on payment. Mr. Pillsbury argued for the bill on the ground that a similar scale in Boston had worked to the betterment of the consumer in reducing price while dividends had been increased.

United States Government Examination for Electrical Engineer.

The United States Civil Service Commission announces an examination on July 22, 23 and 24, 1908, at the numerous places throughout the country where civil-service examinations take place, to secure eligibles from which to make certification to fill one or more vacancies in the position of electrical engineer, at an entrance salary of from $100 to $200 per month, in the Reclamation Service, and vacancies requiring similar qualifications as they may occur. Eligibles from this examination may be appointed as electrical engineers or assistants for the design, installation, or operation of hydro-electric and steam power plants in the West.

The examination will consist of the subjects mentioned below, weighted as indicated:

Subjects	Weights.
1. Mathematics, applied mechanics, mechanics of materials (pure mathematics through calculus, computations of stresses in metal beams, structures, etc., tensile and compressive strength of concrete, etc.)	10
2. Hydraulics (computation of horsepower, plan of connection, water-wheel design, arrangement of pipe, friction losses, discharge of orifices, velocity head, etc.)	10
3. Theory and practice of electrical engineering (design, construction and operation of modern alternating-current power transmission plants)	15
4. Steam turbines and engines	10
5. Drawing and design (layout of hydro-electric and steam-power plant, buildings and machinery)	20
6. Training and experience (rated on application)	35
Total	100

Competitors may also be examined in one or more of the following-named optional subjects: 1. Centrifugal pumps (design and installation). 2. Turbine water-wheels (design and installation). 3. Gas engines. Applicants must indicate which, if any, of the optionals named above they desire to take.

Certifications for appointment will be made (1) of eligibles having the highest ratings on the basis subjects; (2) of eligibles having the highest ratings on the basis subjects and one or more of the optional subjects combined, giving the basis a weight of 2 and the optional or optionals considered each a weight of 1; (3) of eligibles having the highest ratings on one or more of the optional subjects combined and who have also passed on the basis subjects. In making certification as above indicated, no optional in which the rating is less than 70 per cent will be considered. Applicants must indicate in their applications that they have had at least eight years' experience in connection with electrical engineering work in one capacity or another. Graduation in electrical engineering from a reputable technical university will be accepted as two years of this experience. Applicants who have not had sufficient training and experience to entitle them to a rating of at least 70 per cent in that subject will not be admitted to the examination. The use of engineers' handbooks, such as Foster, Kent, Trautwine, or other similar work, will be allowed in connection with the fifth subject, drawing and design. The age limit is 25 to 45 years on the date of the examination, and the examination is open to all citizens of the United States who comply with the requirements.

Applicants should at once apply either to the United States Civil Service Commission, Washington, D. C., or to the secretary of the board of examiners at any place at which civil-service examinations are held, for application Form 1312. No application will be accepted unless properly executed and filed with the Commission at Washington prior to the hour of closing business on July 11, 1908.

Awards of Exposition of Safety Devices.

The award of two gold medals and the distribution of 45 diplomas in connection with the Exposition of Safety Devices in New York, was made May 18 at a luncheon at the Engineers' Club, Mr. Charles Kirchhoff, chairman of the Committee of Direction of the American Museum of Safety, presiding.

Dr. W. H. Tolman, director of the Museum of Safety, announced that there had been 112 entries for the Exposition held at its rooms during the last few weeks. Many of them were new and held at once the interested attention of the engineers and other technical men. Through the co-operation of the *Scientific American*, a gold medal was offered for the most meritorious invention at the Exposition in the field of transportation. The members of this jury are: Prof. F. R. Hutton, Cornelius Vanderbilt, John Hays Hammond, H. H. Westinghouse, George Gilmour, Samuel Sheldon and Stuyvesant Fish, who reported as follows:

"The Jury of Award to select from the safety devices exhibited at the Exposition of 1908 the most meritorious invention in the field of transportation among those brought together, present the following report as their recommendation and award:

"After extended conference and consideration upon the rules which should govern the procedure of the jury, it was agreed:

"1. That the term 'field of transportation' covered by the deed of gift of the *Scientific American* medal included the devices and apparatus having to do with the safety of transfer of the public and of the operatives in control on the railways, by elevators and on the water.

"2. That by the terms of another provision for a Jury of Award for devices and meritorious invention in the field of transportation by motor vehicle, this section of transportation was specifically excluded.

"3. That devices usable in transportation in which safety was a secondary although necessary element, and hence subordinated to a primary purpose other than safety, were not to be considered in competition. Safety must be the primary and perhaps the only object to be sought by the device.

"4. That devices exhibited which were meritorious inventions

were not necessarily entitled to award if there existed other devices not exhibited seeking the same object and having equal or greater claims for consideration.

"Within these limitations the jury decided that any devices to claim consideration must possess the following elements or attributes; and that device exhibiting these qualities to the highest degree should receive the award, viz.:

"1. Applicability, wide or narrow. Does the device procure safety for a large number of persons, or in a great variety of conditions? 2. Practicability. It must be capable of being used successfully. It must not be too cumbrous or intricate to apply or to operate. 3. Simplicity. It must not be so complicated that experts are required to handle it or to keep it in repair and operation. 4. Reliability. It must not be liable to derangement, causing failure to work in emergency. 5. Durability. It must not be so delicate or require such fine adjustment that when installed it will not last in service. 6. Commercial availability. It must not be too expensive in first cost to install, or in operation to maintain."

In applying the above rules and requirements to the exhibits shown in the exposition of 1908 the jury awarded the medal tendered by the *Scientific American* to the Rich marine fire indicating and extinguishing system, and made honorable mention of the Whelin Quadrant. Davit Company and the Simmen Automatic Railway Signal Company.

The gold medal offered by Mr. Francis H. Richards, the inventor, for the best device in the field of motor vehicles was awarded to the Non-Explosive Safety Naphtha Container Company, with honorable mention to the Rutherford Wheel Company. The jurors for this department were Dr. S. S. Wheeler, Mr. Caspar Whitney and Mr. A. G. Batchelder. The winning device can be applied to a gasoline or naphtha can, making the explosion of its contents impossible.

Among other awards yet to be made is that of a gold medal offered by the Travelers' Insurance Company for the best invention in the Departments of Mines and Mining.

A few of those at the luncheon were Commissioner Darlington, of the Health Department; Secretary Larney, of the Fire Department; Deputy Fire Chief Whitney, Dr. S. U. Treadwell, ex-President of the Long Island Medical Association, and Chief Engineer Gilmour, of the Travelers' Insurance Company.

Touching upon the movement to make the museum permanent, a letter was read from Bishop Potter, who has accepted the chairmanship of an educational committee to push the matter. In the letter the bishop says:

"I have gone over your plan for a campaign in the interests of social and industrial peace through a museum of safety devices and industrial hygiene. The plan is practical, of far-reaching importance, and commends itself to my best judgment. I hope that you can find a hearing in every center of influence in our country, particularly the organizations of industrialists and those of labor."

Electrical Inspection; Nebraska Convention Discussion.

At the convention of the Nebraska Electrical Association, at Omaha, May 6 and 7, the question of electrical inspection, and especially inspection in the smaller towns, was discussed at length by central-station and inspection men present. The discussion was started with a paper by Mr. Waldemar Michaelsen, city electrician of Omaha, who enjoys a high reputation for his work in electric inspection and problems connected therewith. He said that one of the popular ideas of an inspector is that his principal duties are to make trouble by condemning work to make a show of his authority.

He reviewed the development of electric light and power work from a distribution voltage of from 50 to 110 volts, up to transmission voltages, and said that the central-station men in the small town was apt to condemn certain requirements because disregard of these had never caused any trouble in that particular town under his particular notice. He said that absence of observed trouble with such limited experience was not conclusive. For example, the central-station man might say that open exposed link fuses, not enclosed in cabinets, had never caused a fire in his town, and that their enclosure was nonsense. If one looked up the record of electrical fires for the whole country, however, he would learn that the open-link fuse, unprotected by a cabinet box, was one of the commonest sources of fire. The National Electrical Code was based on the result of experience the country over, and is the law in many parts of the country. He mentioned the fact that in Europe the governments and not the underwriters make the wiring rules. If it were not for the electrical inspector, the grade of electrical work would not be as good as it is now.

Mr. L. E. Watson asked as to the policy of electrical inspectors on infringement of present rules by old installations made before the rules were as strict as recently. Mr. Michaelsen replied that no reform could be accomplished in a minute. These changes must come gradually. In Omaha all new work is done according to the Code. When additions to old work are inspected, it is customary to look over the old part of the work as well as the new, as some changes might be required on exposed parts of old work. For example, if open-link fuses were found in a location where flying hot metal might set fire to something, the owner's attention was called to the danger and change to enclosed fuses required.

Mr. H. A. Holdrege, general manager of the Omaha Electric Light & Power Company, said that Mr. Michaelsen had sufficiently convinced his company of the desirability of strict electrical inspection to cause it to employ an inspector of its own to look over all wiring done outside of the city limits of Omaha to which the company was asked to connect. This had been brought about by the evident necessity of some supervision of the kind in districts which the city inspection of Omaha did not cover. As an example of what was occurring before this inspection was established, he cited the case of a moving-picture theater in South Omaha, where the arc lamp for the picture lantern was operated from wiring done with No. 14 lamp cord. In some cases they found wiring done with No. 16, 18 and 19 wire. One cottage was even wired-up with weatherproof iron wire such as telephone companies sometimes use.

Mr. E. A. Bullock, of Norfolk, said that in the country towns an underwriters' inspector would sometimes condemn an old building wired in the early days of the industry by the central-station company. The owner would then go for the central-station manager, complaining bitterly that the company had wired the building originally and that it should have done a better job, not understanding the great advance that has been made in the requirements. Mr. H. A. Holdrege said that the requirements on old wired buildings were analogous to fire-district requirements. For example, a city might extend the fire district within which all new buildings must be of fireproof construction, but this did not mean that all wooden buildings within the extended fire district must be torn down. It simply applied to new buildings.

Mr. V. W. Bergenthal said that very few laws are retroactive and apply to things done before the laws were passed. He cited an annoying experience that he had with his own house in St. Louis and the troubles in getting the small wiring contractor to do proper work. He raised the question whether it would not be a good thing to have licensed wiremen. Mr. Michaelsen said that in Omaha they had a master electrician's license. He thought this better than licensing of the wiremen because it is the boss who is responsible for the work, and the man who will pass a good examination to get a license is not necessarily a good workman or honest in his work. He thought it impracticable to have insurance inspectors covering general fire risks inspect also for the electrical risk. Such men knew no more about electrical wiring and risk than the electrical man would know about other hazards. As to the owner of the building wired 20 years ago who objects to rewiring because the wiring was approved at the time it was put in, he would ask him what had become of the suit of clothes he wore when the building was wired. This would set him to thinking as to

whether it was not possible for wiring as well as clothes to wear out in time.

Mr. E. J. Sullivan thought that the central-station manager should condemn bad work in his town before the work was condemned by some outside inspection. The manager would then be in a much better light before his customers than if it appeared he was so lax that outside inspection was needed.

At another session Mr. W. S. Boyd, of Chicago, representing the Underwriters, addressed the meeting on inspection in small cities. Mr. Boyd had previously been in session with the insurance committee of the association to take up this question without agreement having been reached; the insurance committee was continued to take up this subject further, and report next year. Mr. Boyd reviewed the various methods suggested for securing electrical inspection in small cities. One plan was to have the fire chief an electrical inspector, in which case, of course, he would have to become sufficiently educated in electrical matters to be competent. In some cases this had worked very well; in fact, in one case he had in mind the fire chief ultimately resigned to become an electrical contractor, and as a contractor he was a stickler for a high grade of work. Another plan was to have work inspected by other electrical contractors than the one doing the job. This was, of course, open to objections. As to the cost of providing electrical inspection, it could be borne by the merchant having the wiring done or paid for out of the general fund. In some States inspection was paid for out of the general taxes. Such a course was justified fully as much as providing for fire protection out of the general taxes, because safety of electrical wiring concerned all the people in a community. In general, the underwriters favored inspection by municipal inspectors. As a rule, the municipal electrical inspectors were the most competent of any class of municipal employees. State electrical inspection was recently proposed in Illinois, but was defeated because of opposition to it by small central-station companies. Some of the most active opponents of the measure had the most dangerous wiring conditions in their towns and conditions which would be likely to cause trouble. He said that insurance companies, like other capitalists, were likely to be thrown into a panic by successive losses in a town, and when such losses occurred, they called for a general inspection. In such a case the electrical inspector for the underwriters would go through the town and give it such a thorough cleaning out that trouble and discontinuance of electric service by consumers was sure to follow. It was to the interest of central-station companies to keep matters in such a condition that such extreme measures would not be resorted to.

Mr. Michaelsen, discussing this, said that the central-station men in the small towns were entirely to blame for the poor wiring in a town. What the central-station man needed was backbone to refuse to connect to wiring which he knew was not as it should be, and to call the consumer's attention to old wiring which ought to be repaired. Some central-station men had said that they did not wish to condemn wiring because of offending consumers and that they would prefer to have some inspector take the responsibility of condemning the work rather than to do it themselves. He pointed out that it took just as much backbone for a city or insurance inspector to condemn a job as it did for the central-station man. The city inspector realized very well that by condemning work he might make himself unpopular with people who could influence his appointment. The insurance inspector knew that condemnation of a job might mean cancellation of the policy. It was the inspector with the backbone that would do the best, whether he were employed by a central station, city, or insurance company. He showed how it was quite possible for a central-station man or any other inspector to condemn bad wiring without causing offence, if diplomatic. If the inspector or central-station man would go carefully over the work with the owner and explain to him just what the points of danger were, and what was likely to happen if the defects were not corrected, the owner would usually be thankful that these things were called to his attention and frequently would go even farther than the inspector wanted. On the other hand, a simple condemnation of the job without reasons was likely to make any owner wrathful. There are some classes, however, to which nothing will appeal but peremptory orders.

Traveling theatrical companies had been especially difficult to handle in Omaha. He told one story of a theatrical company which went to a great deal of trouble to try to persuade him to allow them to perform in Omaha without certain lamp guards required by the regulations. They maintained that they could not get the guards made in time for the evening's performance, and pleaded various excuses, but later produced the guards from their own railroad car when it was found that the city electrician would not permit the performance without them. Electrical contractors were to blame for lack of backbone in not insisting on being allowed proper time to do wiring in daylight hours, just as plumbers and other workers on a building are allotted a certain period. Instead of that, in Omaha it was customary for the electrical contractor to be obliged to sandwich his work in nights, Sundays and other odd times when the other contractors on the building would give them the chance. He thought that city inspection should be free, because of the tendency of owners to avoid inspection and the fees connected therewith. If city inspection is free, owners are anxious to obtain it. Free inspection of special holiday show-window wiring had kept his department busy in Omaha last Christmas. Probably few would have applied for it if a fee had been charged. He favored free State inspection ultimately, but in the meantime thinks there should be free city inspection.

Mr. E. A. Bullock, of Norfolk, Neb., thought that entirely too much had been said about the electrical hazards and not nearly enough about the various other hazards, especially the moral hazard. In fact, the moral hazard in Nebraska towns was so much greater than all other hazards put together that the electrical hazard was as nothing beside it. He had lived in Norfolk many years, and could count on the fingers of his hands the honest fires. The honest insurance-premium payers are the ones who pay for this, and he, for one, was thoroughly tired of paying for this large moral hazard. Insurance companies were entirely to blame for this in not investigating more thoroughly the causes of fires and the moral hazard. Agents would insure properties up to the fullest extent and then companies would pay losses without protest for fear of losing business in the future. Mr. Boyd replied that more attention had been given to the electrical hazard than to others because of the technical points involved. Any ordinary person knows about the dangers of flues, hot stove-pipes, gasoline stoves and the like, but the electrical hazard requires the attention of technical men. That was the reason more was heard about the electrical hazard than about the others.

CURRENT NEWS AND NOTES.

TELEPHONE COMPETITION IN CUBA.—The advisory commission at Havana has adopted a new telephone law which is stated to open the telephone business in Cuba to competition.

CONVEYING MACHINERY.—Among the papers to be presented before the coming Detroit meeting of the American Society of Mechanical Engineers, is one which will treat in detail the subject of conveying machinery. This paper, which will be in two parts, has for joint authors Messrs. S. B. Peck and George E. Titcomb.

THE NORTHWESTERN ELECTRICAL ASSOCIATION.—Officers of the Northwestern Electrical Association met at Chicago during the week of the N. E. L. A. convention and mapped out a program for the convention to be held at Milwaukee next January. Prof. Meyer, of the University of Wisconsin, expert for the Wisconsin commission, will address the convention, and it is expected that this will form one of the most attractive features of the program. Those present at this committee meeting were Messrs. P. H. Korst, president; John S. Allen, W. R. Putnam, J. H. Harding, R. N. Kimball and L. L. Tessier.

TRAIN MOTORMEN ADMITTED TO BROTHERHOOD OF LOCOMOTIVE ENGINEERS.—The Brotherhood of Locomotive Engineers has voted to admit to membership the engineers of all electrically-drawn trains on steam railroads. It will probably be Sept. 1 before the extension of membership is made effective.

NEBRASKA "QUESTION CLEARING HOUSE."—The Nebraska Electrical Association, in place of the annual question-box that some assocations have, has established a "clearing house" for questions. Mr. L. E. Watson, of Beatrice, is the clearing-house committee. When he receives a question from a member, he mails it on a postal card to the members most capable of answering. Questions of policy are referred to the executive committee.

TRAIN DISPATCHED BY TELEPHONE.—The Chicago, Milwaukee & St. Paul Railroad is preparing to install telephones for train dispatching between Chicago and Milwaukee and between Chicago and Savannah. The Rock Island Railroad is also making plans to adopt a telephone system, and the first switchboard will be installed at Topeka, Kan., for the Kansas Division of the southwest district. The Alton and the Burlington lines are also contemplating replacing the telegraph by the telephone for train dispatching purposes.

CITY INSPECTION FEES.—The Toledo (Ohio) Electrical Company is preparing to test the right of the city to collect fees for making inspections of electrical work. A judgment was rendered against the company some time ago for $85.38 for making inspections of work done by the company. An appeal from the City Court to the Common Pleas Court will be taken. The electrical companies claim that the city discriminates against them because inspections of other lines of work are made without cost.

TRANSMISSION AT 125,000 VOLTS.—Mr. F. E. Greenman, superintendent of the Grand Rapids-Muskegon Power Company, of Grand Rapids, Mich., in a paper on the "Water-Power Development of Michigan," read before the Chicago branch of the A. I. E. E., May 22, said that his company, on June 1, will probably raise the voltage on one of its transmission lines from 72,000 (the present operating voltage) to 125,000. This is to be tried on the steel tower line which has been described in these columns.

MARSEILLES INTERNATIONAL ELECTRICAL EXPOSITION.—The Grand Palais of the Marseilles International Exposition is almost finished, the electrical or "luminous" fountain is completed and pronounced a decided success, and installations of exhibits are now being placed. The Electrical Society of Marseilles will erect a handsome pavilion on the grounds. The wireless telegraph station has been finished and during the exposition regular communication will be maintained with the wireless station on the Eiffel Tower in Paris, and with a government Mediterranean station.

NEW YORK ATTORNEY-GENERAL CANNOT SUE TELEGRAPH COMPANIES.—Judge McCall, of the New York Supreme Court, has denied an application by Attorney-General Jackson, of that State, for permission to institute a suit to annul the charters of the Postal Telegraph and the Western Union Telegraph Companies on the ground that these two companies have entered into an agreement to raise rates and create a monopoly. The court decided that the papers submitted did not establish any merit in fact or warrant in law for granting the permission sought.

CHICAGO MUNICIPAL CURRENT.—Preliminary steps have been taken to substitute current from the sanitary district power plant for that of the municipal electric lighting plant, the council having authorized an investigation of relative costs. Should the plan become effective the city's steam plants could be transferred at little expense to distributing stations for the sanitary district current. The city's law department holds that frontage consents are necessary before the poles and feed wires of the sanitary district can be placed in the city streets. A test case has been brought by the town of Cicero, and another test case probably will be brought by Chicago.

NEW YORK, NEW HAVEN & HARTFORD RAILROAD GOVERNMENT SUIT.—Attorney-General Bonaparte has caused to be filed against the New York, New Haven & Hartford Railroad Company a suit charging the existence of a combination in the restraint of trade and maintaining a monopoly within the meaning of the anti-Sherman act. Among the specific charges is one that the company acquired control over approximately 500 out of 600 miles of electric railway in Connecticut, 400 out of 500 miles in Rhode Island, and about 600 miles in Massachusetts, which railways, prior to such control, were engaged in active competition with the New York, New Haven & Hartford Railroad Company.

POWER PLANT RID OF EELS BY ELECTRICITY.—The run of eels in the rivers and creeks in the section of northern California, near Ukiah, is said to exceed any known for years. The canal built by the Snow Mountain Power Company, from its power houses in Potter Valley, has been swarmed with them, and they piled up at the power station in a manner that threatened to clog the wheels. There seemed to be no way of getting rid of them until electricians sunk a large meshed piece of wire netting in the canal where the eels congregated and when it was well covered several thousand volts were turned into it. The eels were then gathered up and hauled away and buried. Several wagon loads of them have been killed by this means already, according to the account. The Fish Commissioners are particularly interested in this method of destroying eels, as they are one of the greatest destroyers of young trout known.

INTERNATIONAL CONGRESS FOR PREVENTION OF ACCIDENTS.—The eighth International Congress for the Prevention of Accidents will be held in Europe the present year. Its sessions are held every three years and are always attended by influential government officials, publicists, social economists, men of affairs and professors. The reports of the congress are made by eminent specialists, so that the volume of these proceedings is the record of the world's latest and best advances in accident prevention. Of especial value will be the report of an international committee on the "standardization," so to speak, of accidents, their causes, duration and results, so that a world standard may be agreed upon as the basis for a comparative study. Membership in this congress is only $2, which entitles the subscriber to all the reports and the complete proceedings. The membership fee may be sent to Dr. W. H. Tolman, 231 West Thirty-ninth Street, New York, by whom it will be acknowledged and forwarded to Rome.

HENRY'S EARLY TELEGRAPH LINE.—The library of Princeton University contains a manuscript written by Prof. Joseph Henry, which includes a statement relating to his early work in telegraphy. In 1830 Henry, then in Albany, experimented with a telegraph employing a bell for receiver. Later, at Princeton, he erected a telegraph line, and referring to this, the statement says: "I think the first actual line of telegraph, using the earth as a conductor, was made in the beginning of 1836. A wire was extended across the front campus from the upper story of the college library building to the philosophical hall, on the other. Through this wire signals were sent from time to time from my house to my laboratory." The operator at the other end of the line was usually his wife. Parts of Professor Henry's apparatus are still in the Princeton University museum, among them being his giant electromagnet, nicknamed "Big Ben" by the students for whom he constructed it. By electrical communication controlled from his house, this magnet lifted or released a weight of 3000 lb. in his laboratory.

The Post Falls Development of the Washington Water Power Company—II.

BY C. S. MACCALLA.

TURBINES.

EACH water-wheel consists of a pair of 64.5-in. Francis turbines mounted in a steel flume and on a horizontal shaft of forged steel, tapering from 12 in. in diameter at the generator end to 9.5 in. at the other end, and arranged to deliver water into a center discharge case, the latter being bolted to a cast-iron draft tube ring and connected to the draft tube. The wheel shaft extends through packing boxes and a gland on flume head-covers, and is supported externally by ring oiling bearings. The shaft is flanged to receive the runners and one end is flanged to bolt to a flange on the end of the generator shaft. The runners—one right-hand and one left-hand—are made of best grade gun metal cast in one piece, the flange on the runners being bored and drilled to fit the wheel-shaft flange.

The intake or feeder pipe is 11 ft. 3 in. in diameter and is built of 5/16-in. steel. It is about 50 ft. in length along the center line to the flume shell. The velocity of the water in the feeder pipe with full load on the generator is 7.25 ft. per second. The flume shell is made of ½-in. steel, 14 ft. 6 in. in diameter and 14 ft. long. The flume heads are of cast iron, heavily ribbed and provided with a split cover of sufficient size to allow the runner, gates and end of discharge case flange to be removed. The flume is also provided with two manhole covers, drain pipes and valves and lifting rings.

The gates for regulating the quantity of water for the runners are of steel swing-gate pattern, with external operating mechanism connected by a segment gear to a type N Lombard governor shaft.

Each draft tube is 10 ft. 9 in. in diameter at the top and 12 ft. at the bottom; it is 30 ft. long and is made of 5/16-in. steel plate.

The wheel is so located with respect to tail water that the center line of the shaft is 21 ft. above the low-water elevation.

Each unit is guaranteed to deliver on the turbine shaft 3260 hp at an efficiency of 80 per cent when the turbine gates are from 0.70 to 1.00 open and when operating under an effective head of 50 ft.

Three of the water-wheels are type B Victor turbines, built by the Platt Iron Works Company, and the fourth was built by the I. P. Morris Company. The fifth wheel is being furnished by the Platt Iron Works and is similar to the first three machines.

Each alternating-current generator is rated at 2250 kw, three-phase, 60-cycle, wound for 2300 volts, and are Y-connected with ungrounded neutral. It is of the revolving-field type and runs at a speed of 138 r.p.m. Four of the five machines are furnished with extended shafts for the accommodation of direct-connected overhung exciters. Each exciter is of 60-kw rating at 125 volts, and is capable of exciting two of the alternators when the latter are at full-load current operating with 80 per cent power factor.

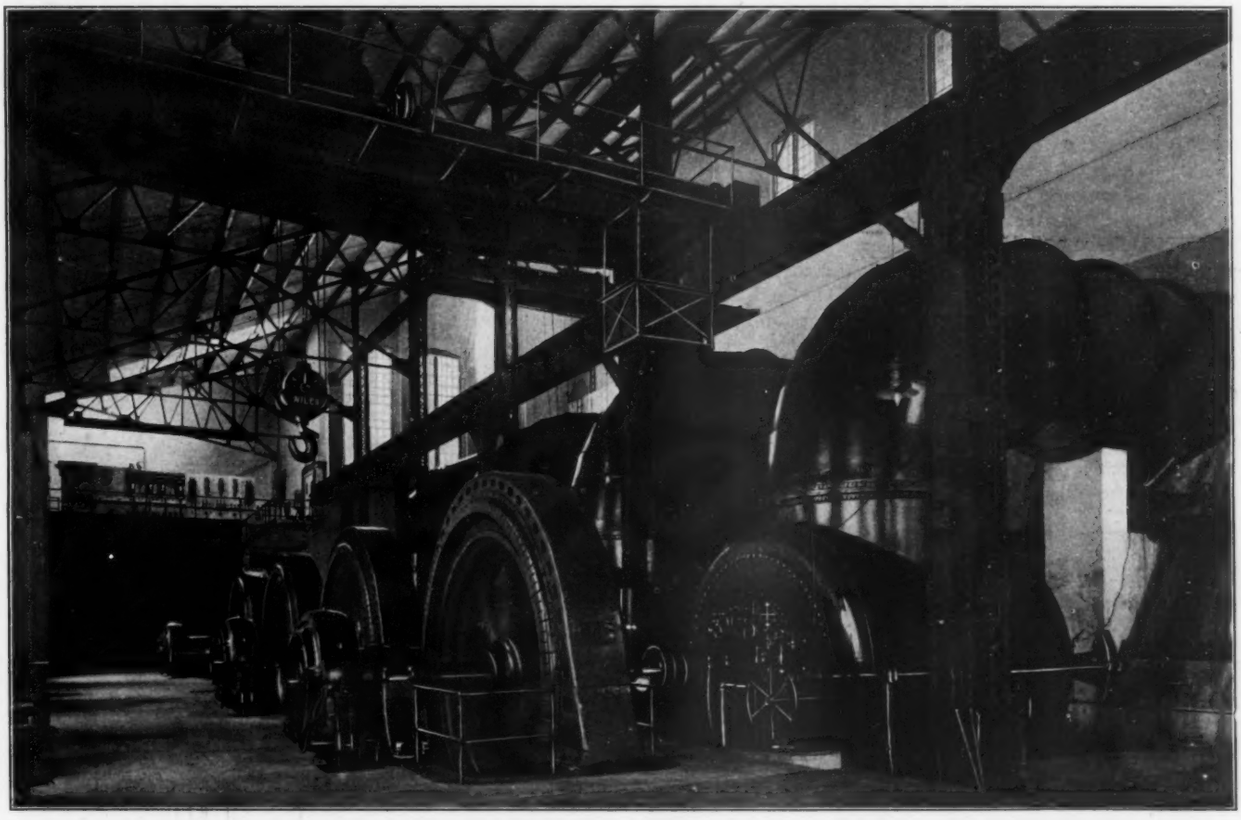


FIG. 7.—INTERIOR VIEW OF POST FALLS STATION, SHOWING TURBINES, GENERATORS AND SWITCHBOARDS.

The alternators are guaranteed to have a full-load efficiency of 95.5 per cent., 94.5 per cent at three-quarter load and 92 per cent at half load, and to give a rise of potential of not to exceed 8 per cent when full non-inductive load is thrown off.

The generators will, at 100 per cent power factor, carry full load for 24 hours with a rise in temperature not to exceed 40 deg. C. above that of the surrounding air, the latter being at 25 deg. C., and will carry a 25 per cent overload for two hours with a rise in temperature not to exceed 55 deg. C.

Each generator weighs 141,500 lb. and has a fly-wheel effect of 1,280,000 ft.-lb.

The exciters have a guaranteed efficiency of 85 per cent at full load and 84 per cent at half load and will carry 15 per cent overload for one hour without movement of brushes and without injurious sparking.

The transformers are wound for 2300 volts, delta-connected on the low-voltage side and 60,000 volts on the high-voltage

side, the latter being star-connected, with the neutral point grounded. The transformers are oil-immersed and water-cooled, each transformer tank having 2200 gal. of oil and requiring 18 gal. of water per minute through the cooling coils.

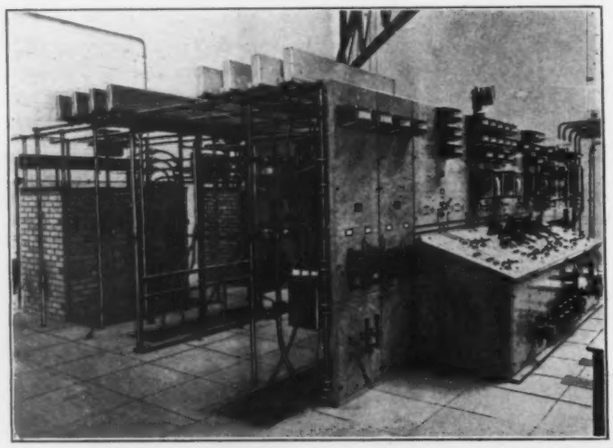


FIG. 8.—GENERAL VIEW OF SWITCHBOARD.

Each transformer weighs, without oil, 40,000 lb., and including oil, the total weight is 57,600 lb.

The transformer efficiencies are as follows: Full load, 98 per cent; three-quarter load, 97.7 per cent; one-half load, 97 per cent, and one-quarter load, 94.5 per cent.

Each transformer is placed in a brick cell, the front of which is closed by a steel rolling door. The oil piping is such that the oil may be drawn off into barrels or discharged directly into the river below the tail-race. The cooling water is piped from the forebay through the dam and discharges into the tail-race. Each transformer is mounted on 6-in. wheels, carried on axles placed in the base casting. These wheels operate on a steel track in the transformer compartment, in front of which is operated a transfer table so that any transformer may be rolled by its own wheels onto the transfer table

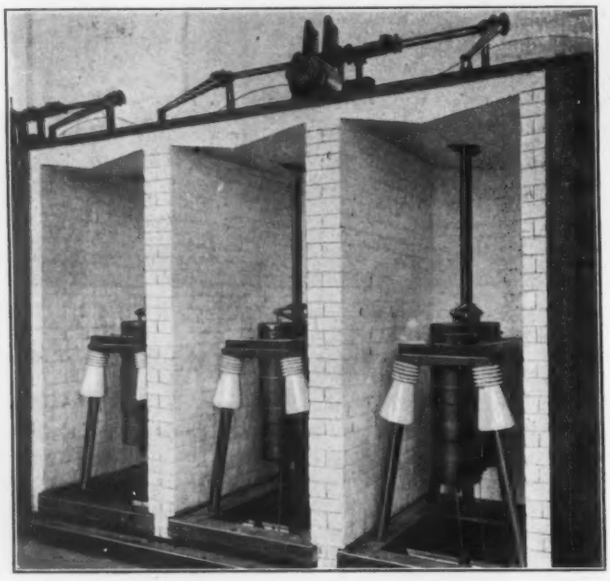


FIG. 9.—MOTOR-OPERATED CIRCUIT BREAKER IN FIREPROOF COMPARTMENTS.

and thence through the door into the generator room where it can be handled by the electric crane.

Behind the main board, on auxiliary marble panels, are mounted the 2300-volt generator disconnecting or selector knife-switches and above these, mounted on a pipe framework, is a 2300-volt transfer bus. By means of these switches a generator may be operated directly with its own transformer or be connected to the transfer bus, and by means of this, connected to any other transformer. A small amount of power is furnished locally from the transfer bus through automatic oil circuit-breakers. In the 2300-volt circuit, between each generator and the knife-blade selector switches, is placed a triple-pole solenoid-operated oil switch located in a fire-proof brick compartment. These switches are equipped with overload definite time-limit relays of the diaphragm type.

One of the most important parts of the plant is the Tirrill regulator mounted on a panel at one end of the bench board. This instrument, acting upon the field coils of the exciters (the latter operating in multiple), regulates the alternating voltage and compensates for fluctuations in pressure incident to a load of varied character, including a large proportion of induction motors, mine hoists, street and interurban railways, etc.

A small storage battery with induction motor-generator

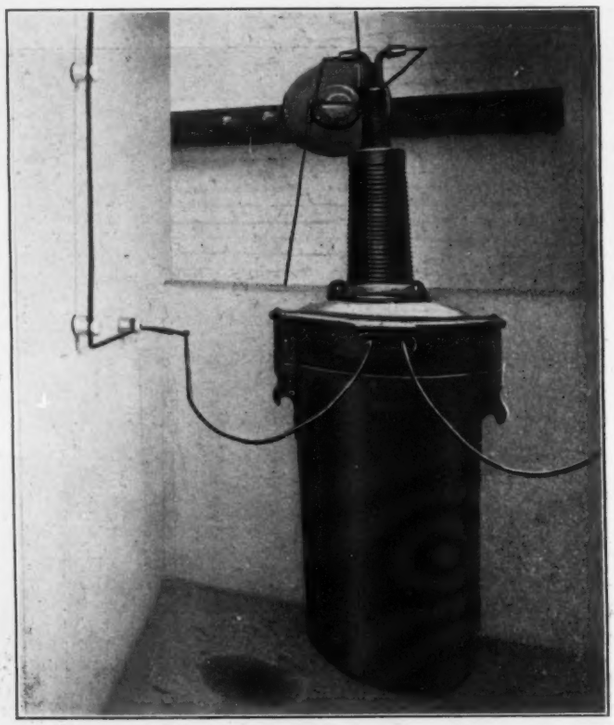


FIG. 10.—TRANSFORMER FOR 60,000 VOLTS IN CONCRETE COMPARTMENT.

charging set is used for the operation of the solenoid and motor-driven switches which may, however, be operated from the exciter circuits.

The building is lighted principally by alternating current, but direct-current circuits are provided which may receive energy from the exciters in an emergency.

The electric crane receives energy from one of the spare 125-volt exciters.

The 60,000-volt switching is done in a building adjoining the 2300-volt switchboard and transformer rooms. The high-voltage leads from the step-up transformers pass through the brick wall of the compartments and thence up to the oil switches. The leads are of bare wire mounted on porcelain insulators 14 in. in diameter spaced 24 in. between wires. A brick barrier separates the leads of adjacent transformers.

The 60,000-volt oil-switches (Fig. 9) are automatic triple-pole, the oil pots in each phase being placed in a separate fireproof brick cell, the three cells of each switch being closed by a wooden door lined with sheet asbestos. The switches are motor-operated and equipped with overload time-limit relays. These relays, as well as those controlling the 2300-volt solenoid-operated switches, are connected to series transformers placed in the 2300-volt circuit, it being considered advisable in this

way to reduce to a minimum the liability of interruption to service by installing as few series transformers as possible in the 60,000-volt circuits. The only transformers of the latter kind are those controlling the switches and instruments in the

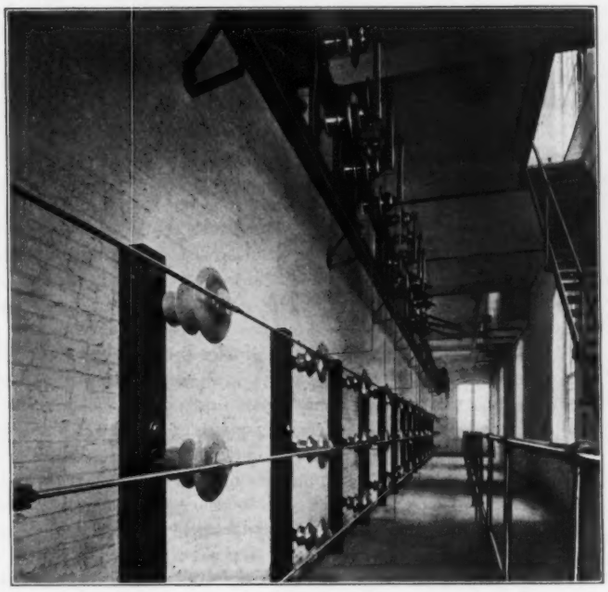


FIG. 11.—ONE OF THE TWO 60,000-VOLT BUS ROOMS.

three outgoing transmission-lines. The high-voltage series transformers are placed in fireproof concrete compartments placed behind the 60,000-volt switch cells (Fig. 10). The secondaries of the series transformers are grounded to a heavy copper wire connected to each of the six 11 ft. 3 in. feeder pipes placed in the concrete dam and connected to the water-wheel casings and draft tubes.

Directly below the high-voltage oil-switches, extending the full length of the building and dividing the lower floor into two rooms, is a brick wall, upon opposite sides of which are

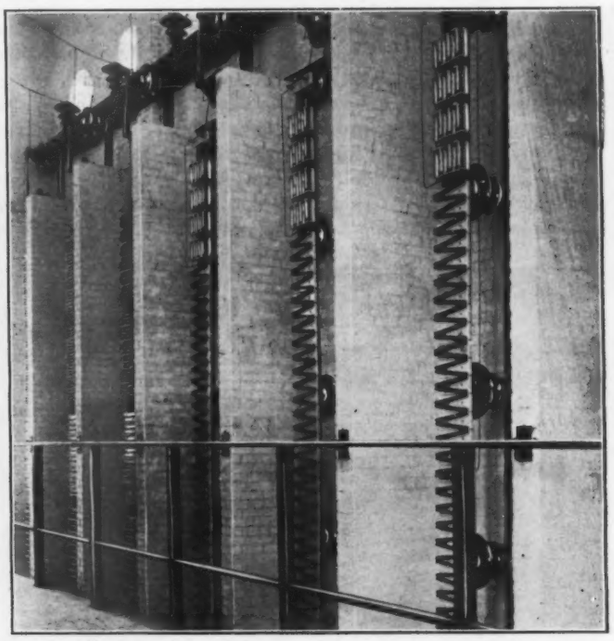


FIG. 12.—THE 60,000-VOLT LIGHTNING ARRESTERS.

mounted the 60,000-volt, three-phase busbars (Fig. 11), each set of which is carried on porcelain insulators 14 in. in diameter with 24 in. between wires. Each set of busbars is connected to each oil switch by three single-pole knife switches. A disconnecting switch is used with each lightning arrester. The arrester (Fig. 12) consists of a series of brass cylinders and air-gaps in conjunction with a spark-gap and carbon resistors and is of the G. E. multiplex-type.

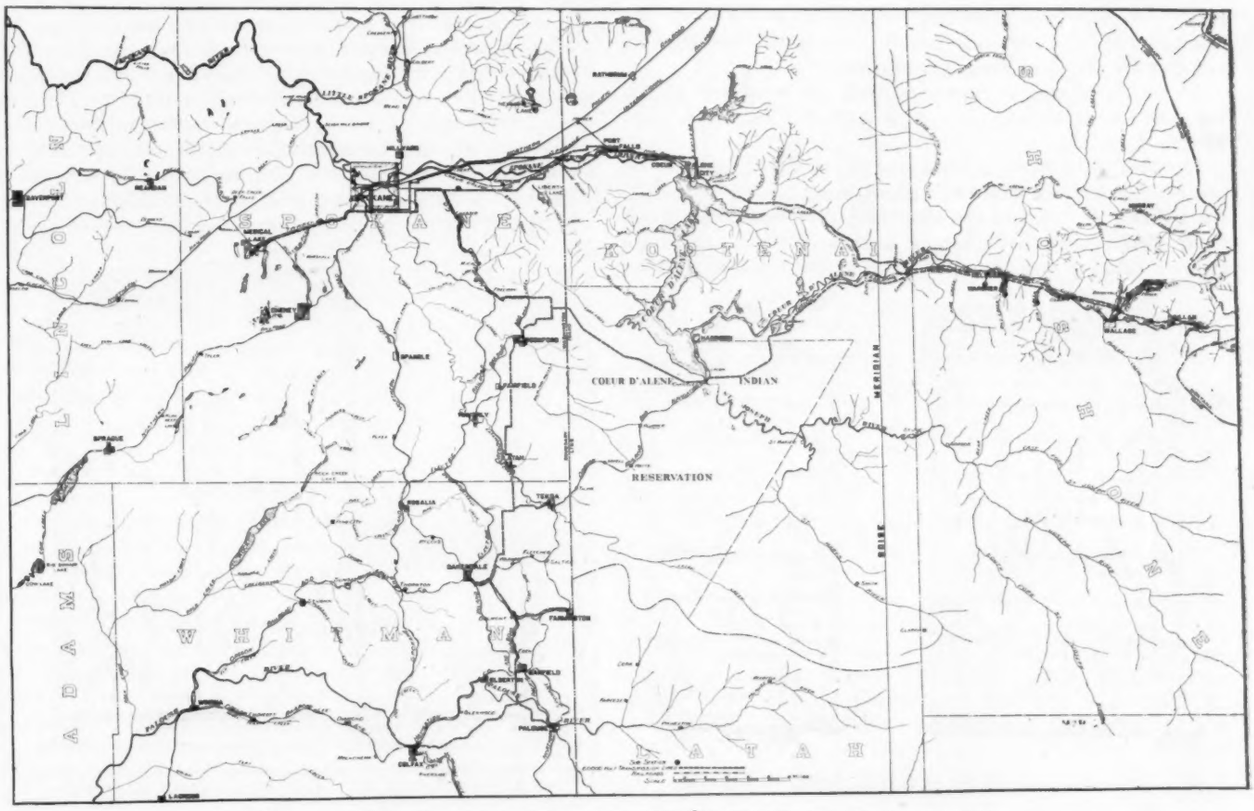


FIG. 13.—MAP SHOWING LOCATIONS OF THE 60,000-VOLT TRANSMISSION LINES.

The Post Falls plant also furnishes energy at 22,500 volts for the operation of the Cœur d'Alene & Spokane Railway Company, a 40-mile, 600-volt interurban line using direct current. The railway company takes three-phase, 60-cycle current from Post Falls, which is nearly at the center of distribution of the road, and thence transmits energy to step-down and rotary converter substations. Energy was formerly furnished from another substation, but upon the completion of the Post Falls plant the transformers were moved there. These consist of three single-phase, oil-cooled Stanley transformers wound for 2300 volts on the primary and 22,500 on the secondary. They are placed in a fireproof room at one end of the 2300-volt

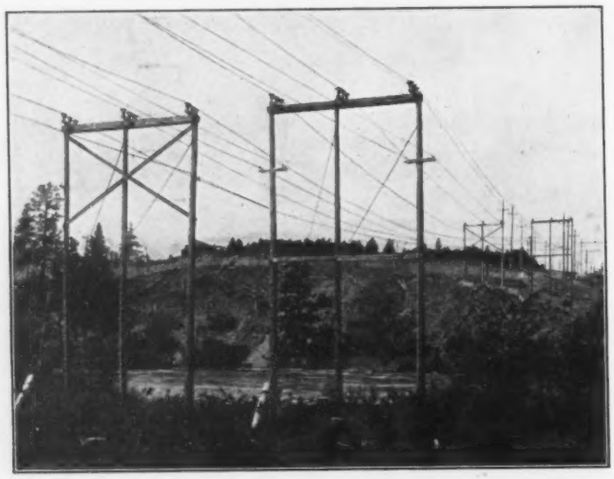


FIG. 14.—TRANSMISSION LINES CROSSING SPOKANE RIVER.

switchboard gallery, and are controlled by a triple-pole automatic solenoid-operated switch, mounted in a brick cell and connected in the 2300-volt circuit. Air-break disconnecting switches are placed in the 22,500-volt leads.

All of the electrical apparatus, with the exception of the three oil-cooled transformers, was furnished by the General Electric Company.

The Post Falls plant is connected to the Spokane plants by two entirely separate 60,000-volt transmission circuits (Fig. 13), one a direct tie line, and the other having branches, one to the Cœur d'Alene silver-lead mining district in Idaho, 100 miles away, furnishing energy to all the principal mines and mills,

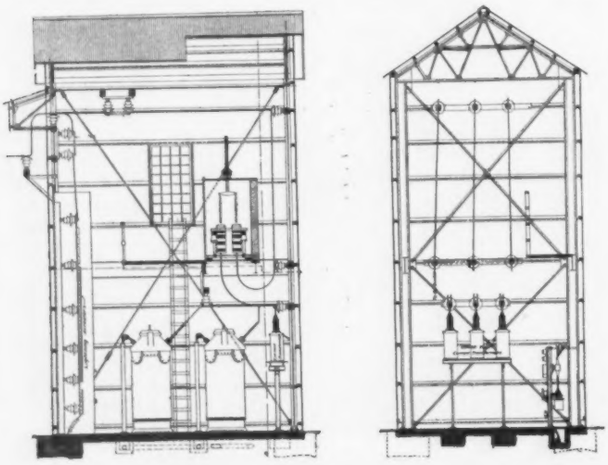


FIG. 15.—ARRANGEMENT OF STANDARD STEEL SUBSTATION.

and the other to the "Palouse Country," in southeastern Washington, where energy is used for operating flour mills and for municipal and commercial lighting, etc. An additional 60,000-volt line, 117 miles in length, which is now under construction, will furnish energy in the territory to the west of Spokane, lying in the "Big Bend" of the Columbia River.

In Spokane energy is distributed for the operation of more than 200 miles of interurban electric railways and 90 miles of city lines; for the operation of the Great Northern and Northern Pacific railway shops; to iron works and factories of all sorts, as well as for municipal and commercial lighting.

In transmission line work both copper and aluminum are used, the former being No. 2 solid medium-hard-drawn, with wires placed at the corners of a 42-in. equilateral triangle and carried on cedar poles spaced 125 ft. apart. The more recent construction has been with No. 0 stranded aluminum, with 84 in. between wires, carried on 45 ft. cedar poles spaced 200 ft. apart. On the "Big Bend" line, now under construction, stranded aluminum is used with an 84-in. spacing, on 45-ft. cedar poles set 300 ft. apart. The lines are graded to compensate for inequalities in the contour of the country. The insulators used on the 60,000-volt line are of porcelain, 14 in. in diameter and 12.5 in. high, and are made in four parts and cemented together.

A metallic circuit telephone line of No. 8 hard-drawn copper, which is carried on a cross-arm below the 60,000-volt wires, connects with all substations and patrolmen's houses.

The transmission wires are transposed (120 deg.) once in every mile, except where the line parallels other transmission lines or telegraph and telephone lines for a distance of a mile or more, in which case an integral number of complete transpositions (360 deg.) is made in the distance in which the lines parallel each other. The telephone line is transposed (360 deg.) twice as frequently as is the transmission line. No trouble whatever has been caused to the long-distance telephone lines which parallel the transmission lines in a number of instances for considerable distances.

The standard 60,000-volt substation construction is shown in plan in Fig. 15 and in cross-section in Fig. 16. Energy is distributed at 2300 volts, 60 cycles, three-phase. In the substation shown the energy is used for the operation of flour mills and for general industrial purposes, as well as for lighting. For the latter, automatic three-phase induction regulators are used to compensate for fluctuations in transmission line voltage, as well as for line loss in the local 2300-volt feeders. The step-down transformers are three-phase, oil-insulated, water-cooled, and wound for 2300 volts secondary and 60,000 volts primary, the latter being star-connected with the neutral brought out to ground. The substations are built of brick, although in some

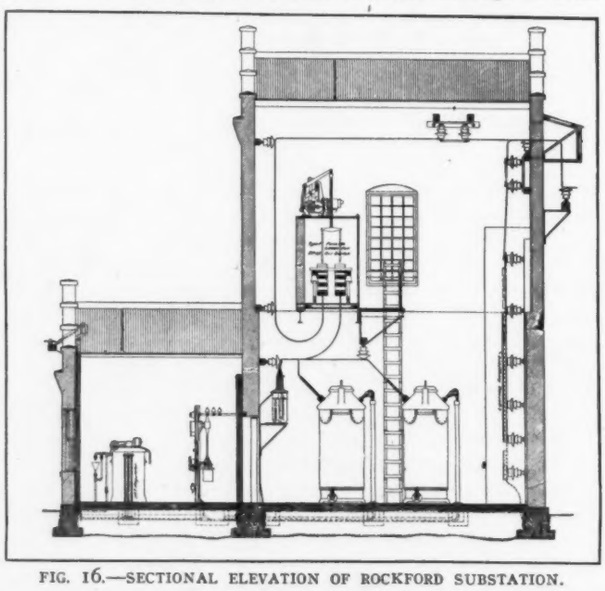


FIG. 16.—SECTIONAL ELEVATION OF ROCKFORD SUBSTATION.

instances an angle iron frame construction is used (Fig. 16), covered with galvanized corrugated iron. The oil switches are of the same general type as are used in the Post Falls station, except that they are hand-operated and electrically-tripped, and are automatic, but without time-limit relays.

The Post Falls development, with the exception of the con-

trolling works in the North Channel, was designed in its entirety by the engineering staff of the company in Spokane, under the immediate direction of Mr. C. S. MacCalla, who was also in charge of construction. The North Channel works were designed by Mr. A. O. Powell, late of the U. S. Engineer Office, St. Paul, Minn. With the exception of the rock excavation and a small amount of concrete work, which was done under contract, the entire development was made by the construction forces of the company under the immediate direction of Mr. W. C. Weeks.

Operation of Large Hydro-Electric Station Switching Apparatus.

BY F. E. CONRAD.

NOTWITHSTANDING the tendency to standardize apparatus in central station construction, it will be found that switchboards are modified to suit each individual installation, or in other words, each switchboard is designed especially for the apparatus it is to control. However, the general principles underlying the design are very much the same, and the great difference in appearance is due chiefly to the selection of instruments and the different mechanical methods of applying the operating devices, and also to the switch and rheostat mountings.

In the design of some switchboards, some very important factors apparently are not given proper consideration, so that in some instances prompt and efficient service is out of the question. Any instrument or appliance tending to complicate the switchboard or that is not absolutely necessary should be excluded. Reliability is of prime importance. Everything about the switchboard should be rugged, simple and designed with the knowledge that it must stand hard service and abuse. Instruments will be subjected to enormous momentary overloads due to short circuits, loss of load and consequently excessive voltage, effects of lightning, etc. It is especially important that remote-control switches should be reliable.

It is not necessary to have delicate instruments on the main switchboard, as they are never used for testing when precise results are desired; portable instruments being invariably used. For instance, the needle of an indicating wattmeter will be continuously swinging even on a steady load, especially when there are a number of alternators running in parallel, due to the cross currents that hold the machines in step, and it is unnecessary to have precise readings for the report. There are, of course, exceptions; the voltmeter used when regulating the busbar voltage should be accurate and should be checked up frequently with a standard; the frequency indicator should also be correct, as well as the watt-hour meter.

It is a great advantage for the attendant to be able to see the scales of all instruments from a central point, and where there are a number of machines operated in parallel to have the panels arranged in a long line is a distinct disadvantage. It is preferable to have the board arranged in the form of a semi-circle. The voltage could then be controlled from a central point where it would be only a step from any machine master switch. This arrangement would be very convenient in case of trouble.

Compactness is a very desirable feature, but should not be carried to extremes. Switchboards of the kind under discussion are usually of the bench board type, and owing to the small space necessary for vertical edgewise instruments, the remote control devices occupy more room than the instruments, and in such cases the instruments should be spaced to correspond to the location of the balance of the appliances for that particular generator. That is, the field switch, instruments, plug receptacles, pilot lamps, switch handles or master switches, relays and rheostat hand-wheel for one generator should be grouped together on a separate panel, or occupy a section of a panel. By this means the apparatus belonging to one generator is grouped as a unit, and in emergencies this simplifies the work and reduces the liability to error.

Each generator should be provided with an indicating wattmeter, which may be either of the polyphase or a single-phase type and calibrated to read total power for the machine; an ammeter to show current in one leg of the circuit, and a field ammeter. It is hardly necessary to say that in large stations of this class all main generators are three-phase units with the load approximately balanced. The field switch and relay should also be on the front of the board, together with the rheostat hand-wheel; although the latter may be located on a stand at a convenient place. If the generator switches are mechanically operated, there are two operating handles; or if the switches are of the remote control type, there are two small master switches with tell-tale lamps to indicate whether the main switch is open or closed. If conditions warrant, the generator time limit relay may be cut out, and the main switch may be opened by the attendant.

Two sets of busbars will require two totalizing panels. These should be equipped with three voltmeters, one for each phase; three ammeters, one in each leg, and a polyphase watt-hour meter, or two single-phase watt-hour meters to show the total output of the station. There should also be a power-factor indicator and a recording voltmeter. A recording wattmeter is a great convenience, as it provides an accurate load curve. A synchronizer should be placed in plain view from any part of the board, and a voltmeter should be placed in the circuit of the incoming generator with the same plug that cuts in the synchronizer. A large, open-scale voltmeter for use in

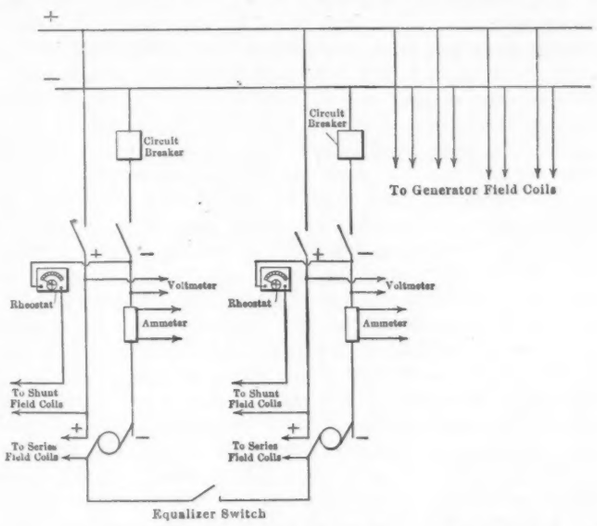


FIG. 1.—DIAGRAM OF EXCITER BOARD WIRING.

regulating the bus voltage, and a frequency indicator under it may be grouped with the synchronizer on the totalizing panel.

All switchboard instruments should have a scale 30 to 50 per cent higher than full load capacity to allow for overloads; but watt-hour meters should be carefully selected with regard to the probable load they will have to carry regularly, and as they are more accurate near full load, their normal capacity should be somewhat lower than the full-load capacity of the station. They will then also indicate light loads quite accurately. Assume that a board is designed to control 12 three-phase, 2000-kw, revolving-field alternators which are direct-connected to water turbines and which generate 60-cycle current at 2400 volts. The voltage is stepped up to 40,000 volts for transmission, over three high-tension lines, each feeding one or more substations. Each high-tension line is in duplicate, and each substation has duplicate apparatus. The high-tension oil switches on the incoming lines are non-automatic in the substations, also the lightning-arrester equipment at the power house transformer room is more sensitive than that in the substations, and the high-tension oil switches at the power house end are equipped with time-limit relays. This arrangement tends to concentrate trouble at the power house where there is a larger force of men to take care of it.

The exciter should be used only for exciting the field coils of the main generators and feeding the station lighting circuits. All motors for pumps, cranes, machine tools, etc., should receive energy from a small set of transformers connected to the main busbars. This arrangement will require no governor on the exciter units, which may be operated with hand-set gates. When running at full speed, one or two additional machines can be cut in with no change of gate, the voltage being adjusted by means of the shunt field rheostat. A slight drop in the speed takes care of the additional load.

Fig. 1 is a diagram of the exciter board wiring. It is an advantage to use single-pole switches so that in case the exciter refuses to build up or builds up reversed, the equalizer switch may be closed, and the switch on the cable coming from the terminal of the series field or the positive terminal (Fig. 1). Care should be taken to keep the switch connected to the terminal coming direct from the brushes (Fig. 1) open, as the switch should only be closed when cutting the machines in parallel, when their voltages are equal. This will connect the series field coils of both machines in parallel, and cause the machine to build up in the proper direction. If the switch should be double or triple pole, the lead must be disconnected at the armature terminal. Sometimes the spare exciter is needed in a hurry, and single-pole switches would thus save valuable time.

After the system is in operation and carrying load, there should be no shut-downs, unless these are absolutely necessary or are due to accidents. It will therefore be necessary to be able to change exciters while carrying load, and to prevent variations in the main bus voltage. This must be very carefully done, and with hand-regulated machines will require an attendant at each exciter turbine gate. When the spare unit is ready, the operators will give the signal to start, closing the shunt field circuit and circuit breaker, also the equalizer switch. The main switches should be placed about an inch from the clips, ready to be jammed shut when the machine is up to voltage. The shunt field rheostat should be cut out so the machine will build up quickly, and the load on the other exciter should be noted. As the voltage picks up resistance should be cut in gradually; this tends to give the machine more speed for the same voltage. When the rheostat resistance is nearly all in circuit the voltage should be allowed to rise as the attendant gradually opens the gate, and when it is equal to the voltage of the other exciter or one or two volts higher, the main switches should be closed. A signal may then be given to stop the other exciter, and the attendant gradually closes its gate while the attendant at the spare exciter continues to open its gate. When the spare exciter has a load equal to that noted before starting to change units, the circuit breaker of the exciter to be stopped should be tripped regardless of any load indicated on the instrument. The operator should be careful not to wait until the machine has no load; because even when the gate is fully closed, and the machine is running as a motor, the load on the spare exciter will continue to increase. The one to be stopped will indicate some load, and as this condition increases, the exchange current between the machines becomes excessive and the circuit breaker will have to be tripped on a heavy current. The spare exciter will also have too great a gate opening, causing a sudden rise in the voltage when the circuit breaker is tripped and this will affect the main bus voltage so that the exciter gate opening will have to be immediately reduced. The gate should be set so that when the voltage is normal the rheostat may be adjusted either to raise or lower the voltage. The gate should be latched in this position, and should not be changed without a signal from the switchboard operator.

The exciters are, of course, compound wound and should never be cut in parallel unless the equalizer switch is closed. When it is desirable to operate the exciters in parallel, the load may be adjusted between the two machines by manipulating the rheostat. Cutting out resistance tends to raise the voltage and increase the load and it is sometimes necessary to make a slight change in the gate opening. Rheostat hand wheels, when properly installed, reduce the voltage when given clockwise rotation, as this cuts resistance into the field circuit and decreases the field current. Counter clockwise rotation of the hand wheel cuts out resistance, allowing an increase in the field current, with consequent increase of voltage.

When switching in a spare exciter in an emergency, it is of course best to close the switches when the voltage is one or two volts higher than that of the machine in service; however, if the voltage of the spare unit should be even 8 or 10 volts higher, it is safe to close the switches. The writer has done this with no bad results and with machines rated at 300 kilowatts. The switches of the spare unit should never be closed when the voltage is lower than that of the machine in service, as it will cause a drop in the main bus voltage. The contact surfaces of large circuit breakers should be cleaned before closing, as a quantity of dust may cause heating when the current is heavy.

In taking up the actual operation of the main switchboard, the writer will assume that each generator is equipped with an indicating wattmeter, giving the load directly in kilowatts, an ammeter giving the current in one leg of the machine circuit, a direct-current field ammeter, a double-pole field switch with auxiliary clips for a kicking coil, a set of receptacles for a six-pole plug that will connect one phase of the machine to the synchronizer, another phase to a voltmeter and the third phase to an incandescent lamp. The two main generator switches are of the remote-control type, so there will be two small master switches to operate them. Each generator switch will have two tell-tale lamps, one green for open and a red for closed, a small switch to operate the signal lamp, a field rheostat hand wheel, and a time limit relay. There are also two totalizing panels, each equipped with three voltmeters, three ammeters, one polyphase watt-hour meter, one recording watt-hour meter, one power-factor indicator, one recording wattmeter, a synchronizer with two pole plugs and receptacle, together with the voltmeter and lamp that is plugged on the generator while synchronizing, and also the voltmeter used when regulating the voltage, and a frequency indicator. Five of the 12 generators are equipped with governors, the remaining seven are started, stopped and the load adjusted on them by hand, the gate being latched to keep it at the desired point. Enough governor machines are run to take care of the variation in the load. The time limit relay on the generator switches are cut out, making the switches now automatic, and in case it is necessary, it can be opened by the operator.

The station report should consist of hourly readings of the load in kilowatts, amperes and field charge of each generator; the main bus voltage, exciter voltage and load, a reading from the watt-hour meter, power-factor meter, and as it is a water-power station, a record should be kept of the height of head and tail water in the remarks column. A complete record of anything unusual, any trouble with cause as near as can be ascertained; in fact, any information that would be probably useful in the future in looking up past happenings should also be written down. All this information should be kept in as clear and concise a manner as possible. Other items, such as weather, temperature, etc., may be incorporated in the report. A record of service of other apparatus, such as transformers, lines, etc., is useful in case of failure, as it can then be definitely ascertained just what service the defective apparatus has given.

After the machines, transformers, lines, etc., have been tested with working voltage and the plant is ready for operation, an exciter is brought up to speed and voltage and kept there. A generator field switch is then closed, and the generator brought up to speed and its main switch closed. This excites the main bus, and the three voltmeters on the totalizing panel will indicate the voltage. The generator field rheostat should now be adjusted to bring the bus voltage to its normal value of 2400 volts. The instrument transformer ratio is 20 to 1, and using the open scale voltmeter it will indicate 120 volts. On this class of instruments there is a small pointer which is set at the voltage it is desired to maintain, and the needle will coincide with this pointer when the voltage is normal. Any

variation will be easily noticed by the attendant. The generator is without load, and this first waterwheel should have a governor, which should now be carefully adjusted to hold the machine at proper speed, so the frequency indicator will stand at 60 cycles. The field charge as indicated on the direct-current ammeter should be noted, as all the main generators are similar. When starting up additional machines, the field current can be adjusted to this value before starting, and no further adjustment is necessary while synchronizing, a difference of a few volts one way or the other being immaterial.

A bank of transformers may now be connected to the live bus, and the high-tension selector switches closed, thereby cutting in a set of high-tension busbars. A transmission line can now be cut into circuit. Each substation on the line should be notified by telephone that the line is about to be cut in; the proper set of selector switches is then closed, and lastly, the main line oil switch. The substations' attendants may then be notified to cut in the transformers and feeders, and customers may proceed to use the energy.

At the main switchboard, it will be found, that as transformers, lines, etc., are cut in, there is a continual drop in the voltage and the generator wattmeter indicates some load. As the load increases, the voltage continues to decrease, and the generator rheostat should be adjusted so as to increase the field strength until the voltage is normal. It is the duty of the operator to watch the voltage and keep it normal. As the load decreases, the voltage increases, and the field charge must be reduced. In this case it requires 112 amperes in the field circuit to generate 2400 volts when running at normal speed.

Now, suppose the load on this one generator has increased and varies from 1500 to 1800 kilowatts; that is, the load has a swing of 300 kilowatts, and at this load, it requires a field charge of 210 amperes to maintain the proper voltage. To provide for a further increase in the load another generator must be put in parallel with the first one. This will require

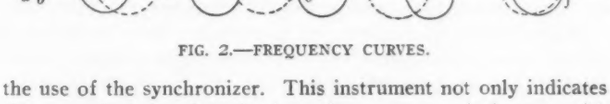


FIG. 2.—FREQUENCY CURVES.

the use of the synchronizer. This instrument not only indicates the exact instant when the incoming generator is in step with the bus to which it is to be connected, but also shows the approximate difference in the speed or frequency, and whether the incoming generator is running too fast or too slow. At the instant the moving hand or needle passes the painted hand on the dial, the machines are in step, and the object is to close the main switch at this instant. However, there is another factor which must be taken into consideration, and that is the speed with which the needle passes this point. Suppose the frequency of the busbar is exactly 60 cycles per second, and the incoming machine is running at such a speed that its frequency is 59 cycles per second; then the needle of the synchronizer will make one complete revolution per second. To illustrate, suppose the frequency of the bus current is five cycles per second and that the frequency of the incoming generator is four cycles per second, as shown by the dotted curve, Fig. 2. At the zero point *a* the machines are in synchronism, but instantly after passing this point, or, say, at *b*, their voltages differ by an amount equal to *c-d*, and the machines are receding from synchronism until the central point of the diagram is reached at *e*, when the zero point in each machine coincides, but the voltages generated immediately after passing this point are in opposition; they then approach each other until the point *f* is reached, when they are again in synchronism. Obviously the time represented by point *e* would be the worst time to connect the machines together, while that represented by the point *f* would be the best. Now, as the needle of the synchronizer is over the painted hand at the exact instant of synchronism, which occurs when the machines are operating under the conditions represented at *a* or *f*, hence at *e* the needle would be displaced 180 deg. or would be directly opposite the painted hand or half a revolution away. It can be seen that the last time for the switch to be closed is at *f* or an instant before, or as the needle approaches the painted hand. There is less disturbance to the system if the switch is closed an instant too soon than if closed too late, and the less difference there is in speed the better. As previously stated, the frequency of the bus circuit is 60 cycles per second and that of the machine 59; the needle will therefore make one revolution per second; if the machine frequency is 59½ the needle will move slower.

In order to cut in the second generator the field switch should be closed and the field current adjusted to the proper value—in this case, 112 amperes. At the same time, the exciter voltage should be 125 volts. As the additional load caused by cutting in the field coils will cause a slight drop, the six-pole plug should be placed in the receptacle. This connects the machine to the synchronizer. On the totalizing panel, the two-pole plug should be inserted so as to connect the other side of the synchronizer to the busbar. The machine may then be started and as it picks up in speed, the synchronizer commences to vibrate rapidly. When the machine approaches normal speed, the synchronizer commences first to revolve rapidly, then gradually, slowing down when the speed of the machine is nearly normal. The operator should now hold the master switch ready to close, and when the needle is moving very slowly and is about 1 in. away from the painted hand the switch should be closed. In doing this, the attendant must use his judgment; the idea is to close the main switch contacts as the needle passes slowly over the painted hand on the dial.

With remote control switches, there is an appreciable space of time between the time of closing the master switch and the instant when the switch contacts come together. This must be allowed for by closing the master switch before the needle gets to the proper point. As soon as the switch contacts close, and the machine is connected to the bus, the needle will remain stationary at the painted hand on the dial. If it slowly comes to a stop at any other point, it shows that the speed is the same, but that the machines are not in step, and if it starts to revolve in the opposite direction, it indicates that the incoming machine is running at too high a speed. When the machine operates too fast, the needle will revolve rapidly, suddenly stop and reverse its rotation. No attempt should be made to get the machine into step until its speed is reduced and brought to its proper value.

When the switch contacts close, if the synchronizer needle jumps forward, it shows that the switch was closed too soon; if the needle is jerked backward, it shows that the switch was closed too late. It is better to close the switch too soon than too late. It is immaterial which way the needle commences to revolve when the machine is coming up to speed; but usually there are arrows on the dial to denote if the machine speed should be raised or lowered, and if the needle does not rotate in the proper direction its direction of rotation may be reversed by transposing one pair of terminals.

There is always the possibility of making a bad shot, and immediately after closing the switch the operator should glance at the machine ammeter, and if there is indication of a short circuit, the switch should be opened instantly. On machines of large size, a generator will pull into step if the synchronizing current does not exceed, say, 200 amperes; but this would be an extreme case. With a little practice and care the synchronizing current can be kept at a very low value, say, from 20 to 50 amperes.

As soon as the generator switch is closed, the gate may be opened slowly and the machine loaded up, care being taken always to keep some load on the governor machine at the lowest swings; and there should be enough governor machines in service so that at the heaviest swings their gates will not be fully opened. For instance, if the load is swinging from 8500 to 12,000 kilowatts seven generators should be used, three of them with governors; four could be set at about 1700 kilowatts each, which would take care of 6800 kilowatts. The

governor machines would then have about 200 kilowatts on a low swing, and a little over 1700 kilowatts on a high swing, and under such conditions very good regulation may be obtained. For heat results, the machines should have approximately equal loads, and the field current adjusted to the same value; but different values in the field currents do not make so very much difference in the regulation, as cross currents between the different machines equalize the voltages, as well as keep the machines in step. If a generator has an abnormally high field current, it will cause the machine to carry an excessive load. A machine of this class will carry approximately 3.7 kilowatts per ampere at a power factor of .90 and at a load of 1800 kilowatts the current would be about 525 amperes. This includes cross currents; and an excessive field current would raise this to 600 or 650 amperes. With the swing in the load there will be a continual variation in the speed; for the same swing in the load this variation decreases, as the number of machines in service increases, or in other words, the fly-wheel effect of the machines improves the regulation. However, this variation in speed causes a variation in the bus voltage, and with hand regulation by means of the generator field rheostats it is useless to try to prevent this fluctuation. Any variation in voltage caused by a variation in speed should not be corrected by adjusting the rheostats, as the governors will restore the speed to normal and with it the voltage. From this it is evident why the frequency indicator should be placed directly over or under the voltmeter used when regulating the voltage, as the attendant can see at a glance if it is necessary to use the rheostats to restore the voltage to normal.

When a decrease in the load makes it necessary to cut out a machine, its field current should be reduced to the same value as that used when starting a machine, in this case 112 amperes. The field currents of the other machines must be increased to hold the voltage up. After closing the gate until the instruments indicate no load, the main switch is tripped. With this system on a low head, with the turbines close to forebay and good governors, properly adjusted, the regulation may be as close as 1½ to 2 per cent on a mixed load.

The switchboard attendant should keep in touch with the character and amount of the station load. He will then know what load to expect and how many machines it will be necessary to have in service at any time. He should also know the relative importance of the loads on different lines and feeders, so that in case of trouble he can give preference to the most important line. A private telephone system installed on the transmission line poles will enable the main switchboard attendant to keep in communication with any substation operator. The latter will receive instructions from the former as to opening or closing feeder circuits, transposing lines, etc., or any necessary changes to eliminate trouble and restore normal service. If possible, it is also well to have a public telephone service installed, so as to have a separate line of communication in case of trouble with the private line. Much trouble may be prevented by watchfulness and attention to details. Defects in apparatus if promptly repaired will often prevent a serious breakdown. The flash caused by opening a switch carrying a heavy current is not only unpleasant, but injurious to the eyes, and it is a good plan for an attendant to cultivate the habit of closing his eyes when opening field switches or tripping circuit breakers.

Dynamometer Wattmeters

In a paper read before the Physical Society of Great Britain, Mr. C. V. Drysdale gave an account of an investigation of the theory of the wattmeter, including the effects of shunt inductance and capacity, mutual inductance, eddy currents, waveforms and of iron. It pointed out that the theory of the wattmeter is much obscured by the use of a correction "factor." The correction of a wattmeter should always be applied as a difference and not as a ratio. It is practically as absurd to apply a correction factor to a wattmeter as to an instrument with a zero displacement.

Preliminary Inspection and Testing of Watt-Hour Meters.

By Joseph B. Baker.

In a previous article (March 7) the writer gave a list of the tools and other apparatus comprising a meter inspector's equipment for testing meters at their place of installation. The following general instructions apply to the testing of unsealed commutator-type and induction-type meters with indicating instruments, on consumers' premises, when two men working together (tester and helper) are employed to make the tests.

The method of testing with voltmeter, ammeter and stop-watch, or with indicating wattmeter and stop-watch (applicable to alternating-current meters) is selected for the presentation of general testing instructions for the reason that this method is the one which has been the longest in use, and is still perhaps the one which is most frequently employed. The "standard-resistance" method, using calibrated resistance, voltmeter and stop-watch, is described briefly herein as a special case of the indicating-instrument method.

In regard to the respective duties of tester and helper it will be assumed that the tester is the man in responsible charge, who carries the instruments, takes the instrument readings, and directs the general conduct of the tests, and that the helper, as the less experienced man, carries the balance of the testing equipment, and takes care of the preparations for the test and the cleaning up afterward. In some companies the taking of the instrument readings is assigned to the helper, as this part of the testing work requires less experience than the observations at the consumer's meter.

The information given represents the present meter practice of several central-station companies, and is drawn from various sources. It is presented somewhat in the form of direct instructions for the sake of clearness and not with any idea of "laying down the law" or with any pretensions of covering all that there is to be known on the subject.

It is customary among many central-station companies to issue written or printed instructions for the government and information of their meter readers and inspectors. There are several advantages of this plan: The instructions give effective assistance in "breaking in" new employees; and the writing and occasional revision of the matter by the heads of the meter department leads to close attention to details, stiffens the general sense of responsibility, and tends to the adoption of improved methods and the elimination of old and inferior ones, so that the matter when kept well co-ordinated and up to date constitutes the final authority among the company's employees.

Upon arriving at the customer's premises the testers should first of all civilly make their presence known to the proprietor or person in charge of the place, and show their meter inspectors' badge. As in all visits of public-service employees, tact and judgment should be used in order to make the test as little of an annoyance to the customer as possible. The men should realize that the testing of a customer's meter, when it means the invasion of his busy office or store, or his private residence, by two men laden with apparatus, may at times be a considerable annoyance to him, and they should, therefore, make as little disturbance and get through their work as quickly and quietly as possible, and be careful to "leave things cleaned up after them."

After recording on the test card the time of arrival, and before removing the meter cover, the tester compares the number on the meter case with the number on the test card, and notes the condition of the seal, and whether the meter is level. The dials should be read by both the tester and helper, independently, and the reading entered on the test card.

The "test card" carried by the meter inspector should be a printed form, having space provided for entering any and every routine or special observation that may be made in testing or inspecting consumers' meters. The form when filled in should itself constitute the permanent record of the meter inspection,

and not be simply a set of notes for transcribing. It should therefore be got up in durable and convenient shape for filing. On the test card used by some companies space is provided for more than a single test, the card being kept in the files of the clerical section of the meter department at all times when it is not in actual use by the meter inspector.

The next thing is to make sure that current is on the mains, noting at the same time whether more than one lamp has to be turned on before the meter will start. The inspector then sets

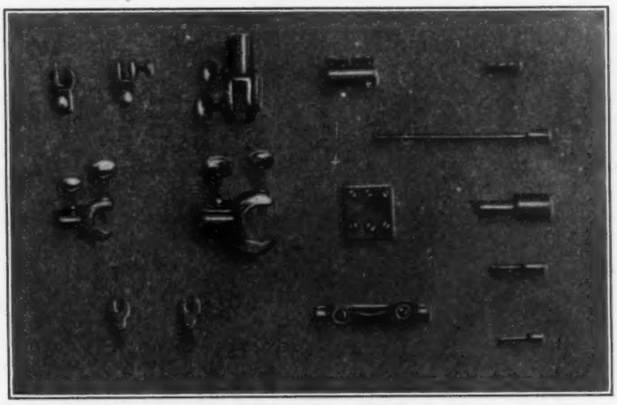


FIG. 1.—ASSORTMENT OF CONNECTORS.

up his instruments (placing them on a box or table if possible, and inserting the potential plug only), and gives the register a preliminary inspection for loose dial hands and defective mechanism. Once placed in position for a test, the instruments should not be moved during the test. The helper in the meantime may be laying out the tools, removing the meter cover, getting the lamp bank (or rheostat) ready for work, and taking an independent check reading of the dial.

In many companies inspectors are instructed to refrain from spinning the shaft of the meter at this stage—or, in commutator meters, touching the commutator or brushes, or, indeed, tinkering with any part of the meter—previous to taking the "as found" readings, as so doing may materially affect the friction and resistance of the moving element, and thereby give misleading results in the tests which follow, particularly the result of the light-load test.

The tester should then remove such wires as are necessary, and if the customer is using electricity the necessary temporary connections should be made so as to continue the service during the test. Fig. 1 shows a useful assortment of connectors that may be carried for making temporary connections in meter-testing work.

In making connections for any method of testing, the potential feed of the meter should not be disturbed, as the opening of this circuit would allow it to cool down from its normal operating temperature and thereby tend to make the meter run fast during the test. The potential wires for the voltmeter must feed from the same point as the potential wires for the consumer's meter.

The correct method of connecting up meter and instruments in

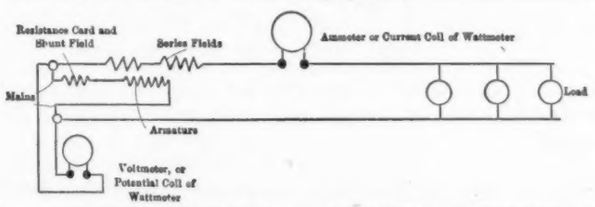


FIG. 2.—CORRECT CONNECTIONS OF INDICATING INSTRUMENTS IN TESTING WATT-HOUR METER.

testing a commutator meter on the consumer's premises is shown in the accompanying elementary diagram, Fig. 2. The voltmeter should not be connected at a point between the meter and the load (as in Fig. 3), since for such connection not only would the energy taken by the voltmeter be registered by the watt-hour meter under test, causing considerable error in the light-load test of the watt-hour meter, but the indications of the voltmeter would be reduced by the fall of potential through the watt-hour meter, causing considerable error (increasing with the load) in the voltmeter readings. In case a wattmeter is

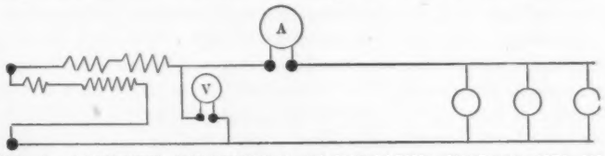


FIG. 3.—INCORRECT CONNECTIONS OF INDICATING INSTRUMENTS IN TESTING WATT-HOUR METER.

used instead of the voltmeter and ammeter, the current coil of the wattmeter is to be connected in the place of the ammeter in Fig. 2, and the potential coil in the place of the voltmeter. The practical connections for testing a commutator meter on artificial load, on two-wire and three-wire services, respectively, are shown in Figs. 4 and 5. The connections require the use of

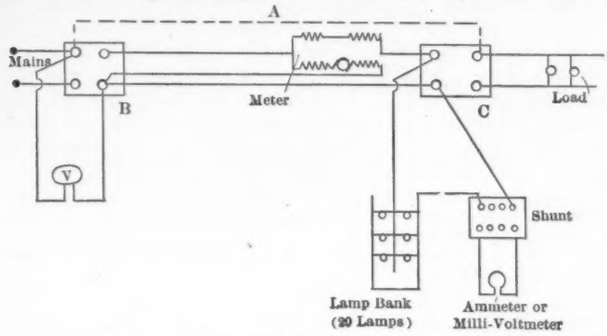


FIG. 4.—CONNECTIONS FOR TESTING A TWO-WIRE METER ON "ARTIFICIAL LOAD."

jumpers, *A*, and the including in the consumer's installation of two cut-outs instead of one.

As good contacts should be made on the potential leads as in the main circuit, to avoid introducing error in the voltmeter indications. The tester should then make the other connections necessary for the tests. These connections include:

The completing of the current circuit through the lamp bank (or other load) and ammeter, when the test is to be made on artificial load. The making of this connection is

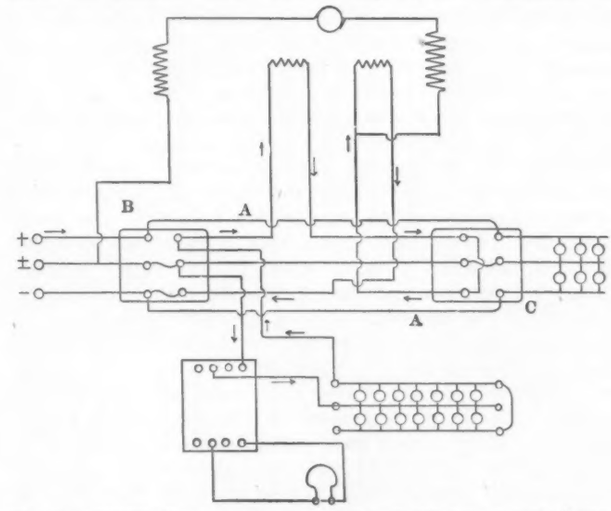


FIG. 5.—CONNECTIONS FOR TESTING A THREE-WIRE METER ON "ARTIFICIAL LOAD."

greatly facilitated, especially in testing meters of large capacity, if a shunt, with milli-voltmeter calibrated in amperes, is employed instead of an ordinary self-contained ammeter.

The cutting-in of the ammeter on the consumer's load when

the latter is to be used as the test load, either with measuring instruments or without them.

The substituting of a portable calibrated resistance for the consumer's load, without ammeter, when employing the "standard-resistance" method; or the substitution of a storage battery or series transformer for the service mains, in testing direct-current and alternating-current meters, respectively, when employing the low-potential method.

The standard-resistance method of testing consists in the employment of a specially constructed resistance, calibrated in the watts taken by it on various voltages, as shown by a table accompanying the resistance. For use in testing alternating-current meters the resistance must be strictly non-inductive, and for testing either alternating-current or direct-current meters it to rise of temperature during the test. Lamp banks may be employed, if recalibrated from time to time to check the increasing resistance of the lamps in use.

This method of testing may be regarded as a special case of testing on artificial load, and will be easily understood, after the foregoing description of the general indicating-instrument method, without the need of a lengthy, separate description. By connecting the standard resistance across the line and in series with the field coils of the meter to be tested and reading the voltage on a voltmeter, the load on the meter (i. e., the "instrument watts") is at once determined for comparison with the "meter watts," given by counting the revolutions of the meter disk and multiplying by the proper constant. The method is usually employed only for testing the smaller sizes of meters,

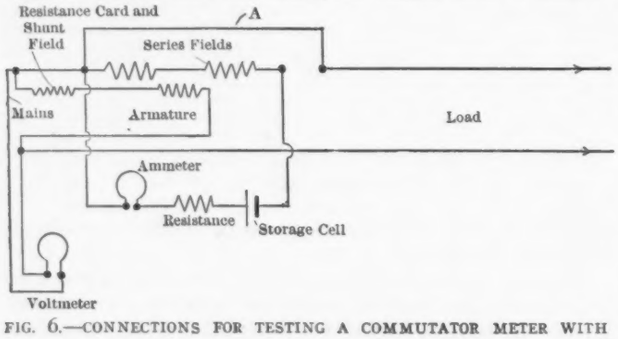


FIG. 6.—CONNECTIONS FOR TESTING A COMMUTATOR METER WITH PORTABLE STORAGE BATTERY AND RESISTANCE.

and the resistance boxes are designed for making both light-load and full-load tests of the consumers' meters.

It is sometimes not practicable to utilize the consumer's load for testing the meter, or to interrupt the consumer's supply in order to substitute an artificial load, or to load a meter of large capacity for testing the meter on the service current. Thus, in the case of a large residential installation, for example, it may be undesirable either to bring on the premises a bulky artificial load or to go through the house turning on lamps.

In such cases direct-current commutator meters may be tested conveniently by passing through the field a low-voltage current of same amperage as the regular load current of the meter. A portable storage battery is used for supplying the series-field coils through a small adjustable resistance, and exciting the armature and shunt-field coils from the full service voltage; the series-field coils of the meter being cut out of the consumer's circuit by a jumper, *A*, and the storage battery connected through them, as shown in Fig. 6. Fig. 7 is a view of a single-cell portable storage battery and resistance for this purpose. Similarly, alternating-current (induction) meters may be tested by using a small portable series transformer for supplying the current-field coils through a small adjustable resistance, the potential field coils being excited from the full service voltage, as shown in Fig. 8. By these means the necessary "load" is applied at low voltage and under perfect control.

Whether the meter is tested with energy from the service mains or from a storage battery, it should be ascertained that the voltmeter is poled right on the mains, and that the connections are brought to the right scale binding posts before closing the voltmeter circuit. In the case of a multi-scale voltmeter it is safest to connect the voltmeter leads to the binding posts of the highest-reading scale first, in order to avoid the risk of damaging the instrument by burning it out or by bending its pointer by an excessive voltage or a reversal. Similarly before closing the load circuit through the ammeter, the full-load current taken should be predetermined roughly in order to avoid exceeding the capacity of the ammeter.

When the ammeter consists of a milli-voltmeter and separate shunt, the shunt may, of course, be connected in circuit without noting its polarity. Before connecting the flexible leads to the instrument, however, the polarity of the shunt binding-posts and the approximate current flowing through the shunt should be determined, in order to avoid injury to the milli-voltmeter.

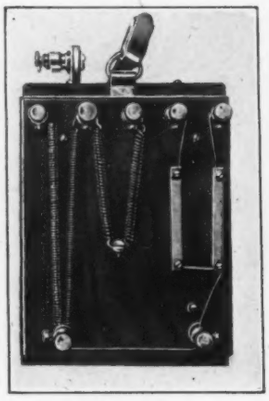


FIG. 7.—STORAGE BATTERY ARRANGED FOR TESTING METERS ON POWER CIRCUITS.

Another thing to be determined before cutting the meter in on the load is whether the meter "creeps"—i. e., whether the moving element revolves when no load is on. If any creep exists, the time required to make one revolution of the disk should be noted in the report, observing also whether the creep is continual or is set up intermittently by occasional vibration of the building by passing trucks or cars, or by the operation of machinery, and estimating the number of watt-hours which would be registered in 24 hours due to creep from all causes.

TESTING PROCEDURE.

During the actual test, by any method requiring two men, it is customary in many companies for the "tester" to read the instruments and make the computations; the "helper" counting the revolutions of the meter disk, under the direction of the tester, by following the spot on the disk, observing meanwhile the general behavior of the meter and calling the attention of the tester to any abnormal features of its operation—such as slow or jerky running, sparking at commutator and excessive friction of brushes, or between worm and worm gear—after the timing of the meter is completed.

Care should be observed to enter all observations and records

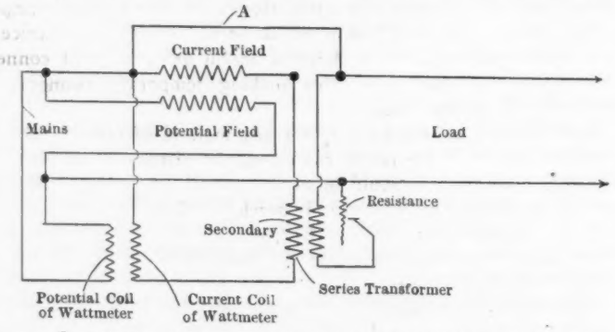


FIG. 8.—CONNECTIONS FOR TESTING AN INDUCTION METER WITH PORTABLE CURRENT TRANSFORMER AND RESISTANCE.

upon the test card at the time they are taken. Nothing should be written, erased or changed on the test card after leaving the premises.

As soon as the tester is ready with his instruments, and with the watt-hour meter running on the given load, the helper holds the stop-watch on the revolutions of the meter disk, announcing the start of his count by the word "on," counting the revolutions aloud during an interval (specified in advance by the tester) of 60 seconds or less, but preferably of not less than 40 seconds, and announcing the finish of the count by the word "off." At the word "on" the tester begins to take readings on the voltmeter and ammeter (or wattmeter in testing alternating-

current meters), taking several pairs of readings (or several wattmeter readings) in the period elapsing between the words "on" and "off," announced by the helper, in order to average for varying voltage or varying load; and being audibly assisted in distributing the readings by the count of the helper.

The necessity and main object of "meter testing" (i. e., testing of the meter followed if necessary by its recalibration) is to keep the speed up to the proper point on light-load. Hence it is important to make the light-load test of the meter at or near the load at which abnormal friction affects the accuracy of the meter most strongly. The induction meter, on account of its lighter rotating element and freedom from rubbing contacts, is more sensitive on light loads than the commutator meter, and the loads given have been agreed upon, in the practice of many companies, as the "light loads" at which the two types of meters should be tested.

Having obtained the disk revolutions and "instrument watts" at light-load and full-load, as described, and knowing the disk constant of the meter, the accuracy of the meter at light-load and at full-load is readily determined. The slide rule should be used in making computations, thereby saving time and errors.

The following equations, directly applicable to meters of the Thomson type, are presented. For two-wire meters: If K (= watt-hours per revolution) is the "disk constant" of the meter under test, and R is the observed number of revolutions in T seconds:

$$\text{Meter watts} = (3600 \times K \times R) \div T \qquad (1)$$

and $$\text{Per cent accuracy} = \text{Meter watts} \div \text{Instrument watts} \qquad (2)$$

Equations (1) and (2) should be used in computing the "as found" accuracy.

Another way of arriving at the per cent accuracy is to compare the actual time in seconds, T, consumed by the meter in making R revolutions with the time that would be required if the meter were perfectly accurate. On this supposition

$$\text{Allotted time} = (3600 \times K \times R) \div \text{Instrument Watts} \qquad (3)$$

and $$\text{Per cent accuracy} = \text{Allotted time} \div T \qquad (4)$$

Equations (3) and (4) can be used to advantage in calibrating when the wattage can be kept constant by the use of a rheostat or lamp-bank load.

Three-wire meters may be tested as two-wire meters by connecting the field coils in series (thereby obtaining an average accuracy of both fields) in one side of the circuit, connecting the load and the potential circuit on that side, and using one-half of the disk constant. The full-load should be one-half of the rated wattage of the meter; the light-load for a commutator meter being one-twentieth of the rated wattage, and for an induction meter one-fortieth of the rated wattage. If the meter is tested as a three-wire meter, two sets of instruments are necessary, one for each side of the meter. and the actual calibrating constant marked on the meter must be used.

Polyphase watt-hour meters are most conveniently tested as single-phase watt-hour meters, by connecting the potential coils in multiple and the current coils in series, and dividing the calibrating constant by two. Either side of the meter may be tested separately, however, by connecting one potential coil only at a time and using the actual calibrating constant.

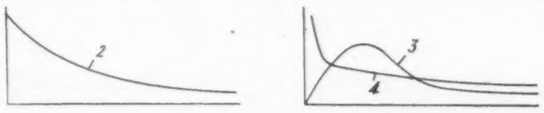
Primary meters, which are used with either series transformers or potential transformers, or both, may be tested as secondary meters. The value of K to be applied in the preceding formula is $k \div rf$, in which k is the meter constant, as marked on the disk of direct-reading meters and on the dial of non-direct-reading meters; r is the product of the ratios of the primary and secondary windings of the series and potential transformers, and f is the correction factor for transformer ratio errors.

It has been found that for watt-hour meters having a straight line accuracy curve, results obtained on the above two loads will more fairly represent the accuracy of the meter than results obtained on any other two loads.

Mr. George Ross Green, in a paper entitled "American Meter Practice," presented at the International Electrical Congress of St. Louis, 1904, says: "It is usually customary when testing meters showing a 'straight line' curve, to test on loads of about 5 per cent and 75 per cent of the rated capacity of the meter on alternating-current circuits, and on loads of about 10 per cent and 75 per cent on direct-current circuits. In the case of complaint and special tests, however, the meters are usually tested on loads of 5, 25, 50, and 100 per cent of the rated capacity of the meter, in order to ascertain more closely the degree of accuracy throughout the range, thus enabling the company, by considering the loads most frequently used, to determine more nearly the actual error, if any exists."

Reactive-Coil Phenomena.

When the source of e.m.f. is withdrawn from a simple reactive coil, either by breaking a direct current or by subsidence of the wave of an alternating current, the voltage upon and current therein induced falls off from the initial value, at first somewhat rapidly and then more slowly, in an exponential curve, as shown in curve 2 of Fig. 1; the controlling elements being the reactance and the resistance of the circuit. But when a closed secondary coil is added, the primary current at first falls off very rapidly, at a rate approximately corresponding to



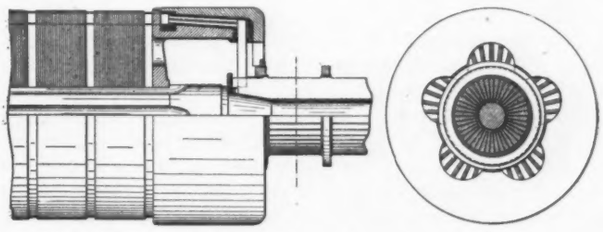
FIGS. 1 AND 2.—REACTIVE COIL PHENOMENA.

the self-inductance reactance of the stray field between the primary coil and the secondary coil. At the same time, there appears in the secondary coil a current which rises at first very rapidly, and then more slowly, reaches a maximum, and then gradually drops. As soon as this rise of current in the secondary coil slows up and ceases, the fall of the primary current also becomes less rapid and ultimately very slow so that the primary current is maintained over a period much greater than is the case without the secondary coil. This interaction of the two coils is shown in Fig. 2 where curve 3 represents the rise and fall of the secondary current, and curve 4 represents the changed primary current due to the retarding of the drop in voltage by reason of the counteraction of the secondary coil.

According to a patent issued April 7, Dr. C. P. Steinmetz proposes to employ short-circuited secondaries in connection with the reactive coils of mercury-vapor rectifiers in order to obtain a discharge curve extending over a long period of time. The secondary coil has fairly good mutual inductance with the main coil, but there is some stray field between the two coils.

High-Speed Direct-Current Generator.

The accompanying illustrations show a form of direct-current turbo-generator construction disclosed in a patent issued to Mr. B. A. Behrend on April 28. The end-ring, or bell, which supports the end of the coils which project beyond the



FIGS. 1 AND 2.—HIGH-SPEED DIRECT-CURRENT GENERATOR.

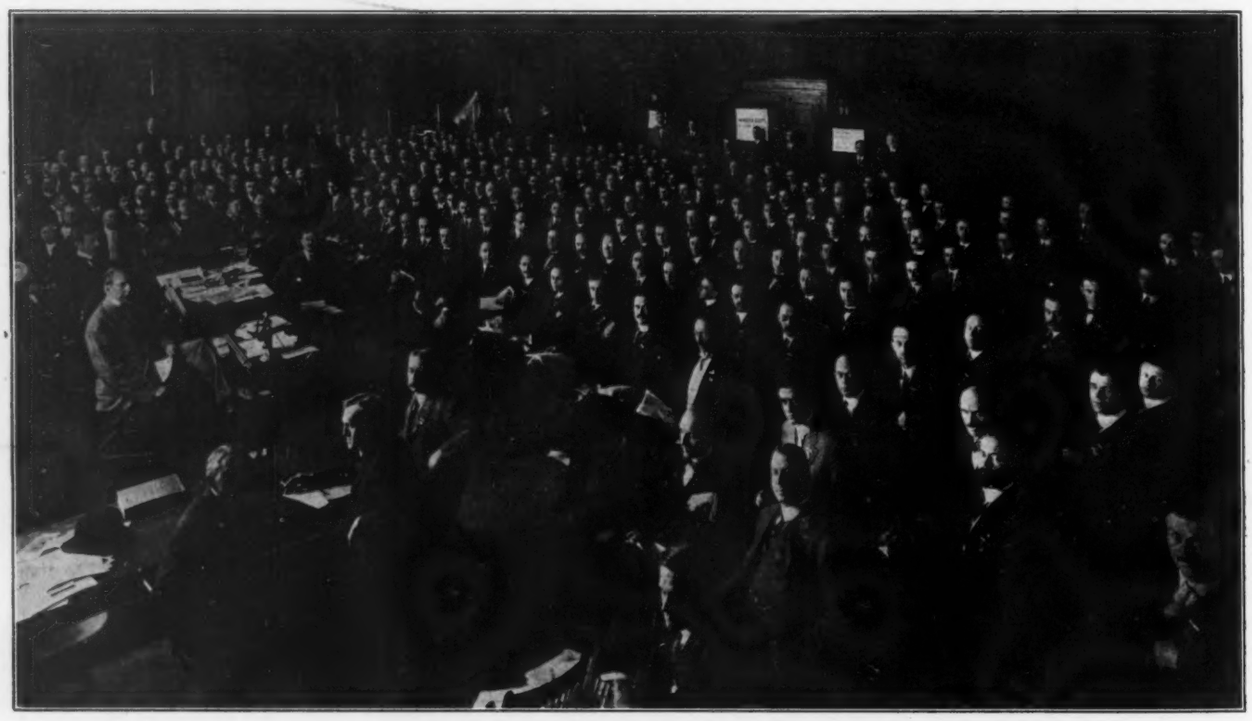
commutator-end of the core, extends inwardly to the clamping-ring for the commutator, the latter ring supporting the former. The clamping ring is threaded externally, and is provided with a nut which bears against the end-ring and thus holds it in position. The armature is simple in construction and compact, and is able to withstand the enormous stresses at high speed without danger of any of its parts being displaced or injured.

Chicago Convention
National Electric Light Association

DETAILS were given in the Electrical World of May 23, by telegraph, with regard to the opening exercises of the thirty-first convention of the National Electric Light Association at the Auditorium, Chicago. Subjoined will be found a continuation of the report, with a résumé of such papers and discussions as have not been previously referred to or upon which further action was taken.

The convention as a whole may be spoken of as the most successful in the history of the association. The attendance at the regular exercises was most exemplary, and although the meeting room would easily accommodate 500 people, there were times when it was unduly crowded. In fact, at one of the sessions the doors were literally stormed, and after standing-room was at a premium there were still crowds clamoring to get in, the week. Of these 247 were ladies—rather a small proportion, but enough to prevent the convention from being of a wholly serious and matter-of-fact character. Note is made elsewhere of the various entertainments and functions provided for the amusement of visitors. The weather at the opening of the week was of a disagreeable character, but as the meeting advanced conditions improved, and from Wednesday onward the climate and temperature were ideal, and many favorable opinions were expressed with regard to the attractions of Chicago as a summer resort. The attendance at the exercises was maintained until the last moment, including the extra session of Friday afternoon, necessitated by the various discussions.

The new ticket elicited general and hearty approval, President



THE CONVENTION IN SESSION, MORNING OF THIRD DAY.

resenting the statement that it was difficult to find room for them. During part of the week parallel sessions were held, and even this experiment did not seem to lessen the interest in any degree, as neither meeting suffered from the division, and both were extremely well attended by at least two or three hundred of the members. When one considers the distractions of a great convention, the exhibits, the entertainments, the opportunities to transact business, and the local commercial engagements of the members, such facts speak volumes for the earnest spirit that pervades the association as a whole.

On Friday morning—the last day of the meeting—members were still being registered, and the total had reached 1850. As there were a number of members present who had not called for their badges and others who were attending because of the discussions of subjects in which they were interested from an outside standpoint, it can readily be seen that the attendance of well over 2000 is accounted for, and the estimate of the authorities was that at least 2200 persons had attended during

Eglin having taken a most active, public-spirited share in the work of the association for many years past, while the other offices were also filled notably with younger men, whose energy and influence are expected to develop the association along progressive lines. Over and above all was heard the universal expression of thanks and gratitude toward the Commonwealth Edison Company for its lavish but judicious and dignified hospitality, leaving nothing undone that could minister to the comfort and convenience of every visitor. The administrative work of the association, under Miss Billings, was also attended to with minute care, registration being rendered easy, copies of papers being available for all concerned; while the meetings were conducted with precision and smoothness, so that there was no lost motion at any time. It is probable that the plan of holding separate parallel meetings may be renewed at the next convention as a means of disposing of the plethora of papers and business affecting the technical and commercial interests of the industry.

The following is a statement in condensed form of the proceedings of the four days' convention beginning Tuesday, May 19, and ending Friday, May 22.

The session was opened Tuesday morning by the address of President Dudley Farrand, of Newark, N. J., which was briefly summarized in our telegraphic report of last week. This was followed by the presentation of the annual report of central station progress by Mr. T. C. Martin, which he summarized briefly. This covered such a wide range of subjects that the discussion of it was left to be taken up at various times during the convention in connection with the special papers on the various points mentioned.

Next in order was a paper by Mr. George H. Lukes, of Chicago, entitled "Distribution in Suburban Districts." This was discussed at length, and as a result of one question brought up in the discussion a committee was appointed to report at a later session to draft a resolution as to the sense of the association on what constitutes a "high-tension" circuit, such a question having been asked the association by the Public Service Commission of New York through Mr. H. M. Edwards. This committee reported on Friday, as noted later. A paper on "Tape," prepared by Mr. Paul Lupke, of Trenton, N. J., was read by Mr. T. C. Martin.

ACTION ON GROUNDING SECONDARIES.

The report of the committee on grounding secondaries was made by Mr. W. H. Blood, Jr. This report was discussed at the beginning of the Tuesday afternoon session. The report, as noted in our issue of last week, favored the adoption of a rule by the underwriters whereby the transformer secondaries of distributing systems must be permanently grounded when the difference of potential between the ground and any part of the circuit would be less than 150 volts. When the difference of potential between the ground and any part of the circuit would exceed 150 volts, they must not be grounded. After discussion in the afternoon session the resolution as presented by the committee was adopted.

CHANGES IN ORGANIZATION PROPOSED.

The next number on the program was the report of the committee on "Organization" by Mr. Henry L. Doherty, of New York. This proposed important enlargement of the scope of association work, which included taking in the various State electric light associations, was referred to a committee. President Farrand appointed the following on this committee: Messrs. W. W. Freeman, of Brooklyn; F. M. Tait, of Dayton, Ohio; L. A. Ferguson, of Chicago; W. H. Blood, Jr., of Boston; Arthur Williams, of New York.

A paper on "Power Development in Small Stations" was presented by Messrs. Jas. Robbins and J. R. Bibbins, of Pittsburg. This was discussed at length. "The Small Station and Its Mechanical Operation" was the subject of a paper by Mr. J. T. Whittlesey and Mr. Paul Spencer. Mr. A. J. Campbell, editor of the Question Box, presented a paper on the "Future of the Question Box."

STANDARD CLASSIFICATION OF ACCOUNTS ADOPTED.

The committee on "Uniform Accounting," consisting of Messrs. H. M. Edwards, auditor of the New York Edison Company; E. J. Allegaert, auditor of the Public Service Corporation of New Jersey; E. W. Brunderett, general auditor of the United Gas & Improvement Company, Philadelphia; John L. Bailey, treasurer, Consolidated Gas, Electric Light & Power Company, Baltimore, Md.; Frank L. Dame, Electrical Securities Corporation, New York, presented a report recommending a classification which was a modification of that presented last year. This classification, it was stated, is approved by the accounting committee of the American Street & Interurban Railway Association and other allied interests. After a brief discussion the report of this committee was adopted.

CANDLE-POWER STANDARD.

A resolution was then read which was sent in by Dr. A. E. Kennelly, secretary of a joint committee consisting of sub-committees of the American Institute of Electrical Engineers, American Gas Institute and the Illuminating Engineering Society. This resolution in regard to the common unit of candle-power was as follows:

WHEREAS, A joint committee composed of sub-committees of the American Institute of Electrical Engineers, American Gas Institute and the Illuminating Engineering Society have prepared resolutions favoring the determination of a common unit of candle-power for the United States, and with the expectation of ultimately obtaining an international agreement upon a common unit of luminous intensity to be used throughout the world, and

WHEREAS, Such committee recommends that during the interval required for the consummation of international action, a common candle unit be used, which shall be 2 per cent less than that now maintained at the Washington Bureau of Standards,

Resolved, That this association hereby approves the recommendation of the said joint committee, and further

Resolved, That the secretary be instructed to address a letter to the director of the Bureau of Standards at Washington, D. C., enclosing a copy of these resolutions and requesting that the Bureau of Standards maintain as its working candle unit from this time on until definite international action shall have been taken, a common unit 2 per cent lower than that which it is maintaining at the present time. Further

Resolved, That the secretary be instructed to address to such similar foreign societies as may be interested, a statement of the movement in the United States toward a common international candle unit (enclosing a copy of these resolutions) and requesting the co-operation of such foreign societies in advancing the movement.

This resolution was adopted. The meeting then adjourned until Wednesday morning.

Wednesday morning the first item on the program was a paper by Prof. A. E. Kennelly and S. E. Whiting, of Harvard University, on "Some Observations on Photometric Precision." As the authors were not present, Mr. Preston S. Millar, of the Electrical Testing Laboratories, read this paper in abstract. This was discussed by Messrs. J. B. Klumpp and Preston S. Millar. A paper on "Low Pressure Steam Turbines," by Mr. John W. Kirkland, of Schenectady, N. Y., was next read and discussed at some length.

Following this the secretary announced that Mr. L. A. Ferguson, chairman of the entertainment committee, desired to make an announcement, and incidentally remarked as a matter of interest in connection with said chairman that he was yesterday, by a vote of 1766 to 99, elected president of the American Institute of Electrical Engineers. The announcement was received with long-continued applause, much to the embarrassment of the unsuspecting chairman of the entertainment committee, who was not expecting that the secretary would thus take advantage of his request to make a few simple announcements in connection with the entertainments. The convention then took up the report of the committee on "Gas Engines," by Messrs. W. C. L. Eglin, of Philadelphia; J. B. Klumpp, of Philadelphia; I. E. Moultrop, of Boston, and C. H. Williams, of La Crosse, Wis. After Chairman Eglin read this voluminous report in abstract, there was a long discussion. Mr. L. A. Ferguson, chairman of the committee on "Meters," presented the report of that committee, the members of which are Messrs. L. A. Ferguson, Chicago; Alex Dow, Detroit, and J. E. Montague, Brooklyn.

On Wednesday evening the first paper taken up was that by Mr. P. D. Wagoner, of Schenectady, on "Series Incandescent Systems with Tunsten Lamps," which brought out considerable discussion. The meeting then passed into executive session, and heard the report of the secretary and treasurer. The receipts for 1907 were $31,254.19; expenses, $23,895.14; balance, $7,359.05.

The report of the committee on "Public Policy," of which Mr. Arthur Williams was chairman, was presented by Mr. Samuel Insull, of Chicago. This was discussed at great length and received. A paper on the "Status and Commercial Possibilities of High-Efficiency Lamps" was read by its author, Mr.

W. W. Freeman, of Brooklyn. Discussion of this was left until the following day.

A nominating committee to nominate officers and executive committee for the ensuing year was elected as follows: Messrs. N. F. Brady, J. B. McCall, E. H. Davis, C. R. Huntley and P. T. Glidden.

When Thursday morning's session was called, Mr. C. R. Huntley, of Buffalo, past president, announced the death of Mr. R. C. P. Holmes, of the Commonwealth Edison Company, who was found dead on the streets early that morning, supposedly as a result of an assault for robbery. The convention immediately adjourned until 1:30 p. m. out of respect to this member.

COMMERCIAL DAY PROGRAM.

On Thursday afternoon the convention was opened with a discussion of a paper on the "Commercial Possibilities of High-Efficiency Lamps." This naturally proved a very interesting subject and brought out much discussion. President Farrand then gave the chair to Mr. Henry L. Doherty, past-president of the association, who by previous arrangement had been selected to take charge of the Commercial Day program. This Commercial Day program was opened with an address by Mr. L. A. Ferguson, of Chicago, on "The Relationship Between the Engineering and Commercial Departments." This was followed by a number of reports or symposiums on commercial topics prepared by various committees of editors. The first of these was by Mr. H. J. Gille, of Minneapolis, on "Preparation for a Campaign." After the discussion on this, the subject, "The Contract Agent and the Representative," was taken up by Mr. V. A. Henderson, of Memphis, Tenn. This was supplemented by Mr. M. E. Turner, of Cleveland, and discussed by various others.

At this point the chairman called attention to the serious illness of Mr. J. Robert Crouse, of Cleveland, to whom he referred as "a man practically unknown to us three years ago, but who by his aggressive work has commanded our complete respect." Mr. Crouse, he said, had been taken down with nervous prostration, largely due to the work done in behalf of this association. He might be unable to get back to his duties for many months. Mr. Doherty believed the association could have afforded to lose the services of almost any other man for the next few months rather than those of Mr. Crouse. Mr. Arthur Williams also spoke feelingly of the work done by Mr. Crouse in arranging the first Commercial Day program, which was held at the Washington convention last year. He moved that the chair appoint a committee to draft suitable resolutions of regret for Mr. Crouse's absence and hope for his speedy recovery, which motion was carried.

The chairman also spoke appreciatingly of the work done by Mr. C. W. Lee in arranging the Commercial Day program. Mr. L. D. Mathes, editor of the paper on "Display Room," presented that report, which was discussed. As it was time to adjourn and the Commercial Day program was not completed, it was then decided to continue the program over into the parallel session which was for Friday morning at 10:15 o'clock. In order to get through with the work the commercial meeting Friday morning was called to order about 8:45, at which time the Commercial Day program was continued. The reports edited by Mr. Charles A. Parker, of Detroit, Mich., on "Advertising," were read and discussed. A report on "Publicity," edited by Mr. Percy Ingalls, was briefly abstracted in Mr. Ingalls' absence by Mr. C. W. Lee. A report edited by Mr. George N. Tidd, of Scranton, on "The Evolution of New Business Building," was then presented.

COUNCIL OF PROGRESS AN INNOVATION.

The regular Commercial Day program was interrupted at this point to listen to addresses which had been arranged for that hour under the head of "Council of Progress." Hon. Leslie M. Shaw, ex-Secretary of the Treasury, spoke on "Conservatism." Mr. John R. Morron, president of the Diamond Glue Company, of Chicago, gave an address on "Commercial Progress." Mr. W. D. Robertson, of the Robertson Electric Company, Buffalo, N. Y., spoke on the "Sons of Jove." Mr. George Macbeth, president of the Macbeth-Evans Glass Company, Pittsburg, spoke on the "History of Lighting Science." After these addresses the delayed Commercial Day program was resumed. A report edited by Mr. Frank B. Rae, Jr., of New York City, on "Creating Demands for Electricity," profusely illustrated with lantern slides, was read by Mr. Geo. Williams, of Cincinnati, and met with a very cordial reception. A paper on "Illuminating Engineering as a Commercial Factor," illustrated with lantern-slide views, was presented by Mr. V. R. Lansingh. Mr. Joseph F. Becker, editor of a report on "The Electrical Contractor," presented his paper, which closed the session.

In the regular session Friday morning the first paper taken up was entitled "Receiving Stations Operated from High-Tension Lines," by Mr. A. W. Hayes, of Pittsburg. This was immediately followed by the report of the committee on "Protection from Lightning, and Other Static Disturbances," by Mr. R. S. Stewart, of Detroit. This report drew out considerable discussion. The secretary at this time announced that the registration of those in actual attendance at the convention was approximately 1800, which was by 150 the largest convention ever held by this association. He estimated that about 200 failed to register, which would bring the attendance to substantially 2000. Mr. H. D. King, of Hoboken, N. J., read his paper on the "Value of the Care and Maintenance of Meters," which was briefly discussed.

DEFINITION OF "HIGH-TENSION."

The convention then listened to the report of the special committee which was appointed to consider the question of the definition of "high tension." Mr. Paul Spencer, chairman of that committee, which consisted of himself, Mr. G. H. Lukes, of Chicago; Dr. C. P. Steinmetz, of Schenectady; Mr. E. H. Davis, of Lewiston, Pa., and Mr. I. E. Moultrop, of Boston, made a report to the effect that it had carefully considered the question raised at the sessions of Monday morning as to the limitations implied in the term "high tension." The committee feels that the terms "low tension," "medium tension," "high tension," and "extra high tension" are purely relative and that no definite voltage limitations can be stated that would cover at all satisfactorily the conditions to which these terms are applied. The adoption of the term "high tension," as applied to a voltage over a certain stated amount, may carry with it the unwarranted implication that voltages in excess of such a stated figure are under all conditions hazardous. As far as overhead line construction is concerned, any line voltage can be safely installed and operated if the methods of construction are adapted to the voltage carried. Therefore, in view of the purely relative value of the term "high tension," the committee unanimously recommended that no definite resolution be adopted at this time. The report of the committee was adopted.

Mr. Paul Spencer, of Philadelphia, presented the specifications for construction of joint poles agreed upon by conferences between the engineers of the large telephone and electric light companies of New Jersey, which specifications are also now the standard for the Bell Telephone Companies the country over.

The "Self-Synchronizing of Alternators" was taken up in a short paper by Prof. Morgan Brooks, of the University of Illinois, and a practical demonstration of synchronizing was given. A synchronizer and ammeters were mounted on a board in front of the audience and connected with a motor-generator at the Harrison Street station of the Commonwealth Edison Company. This motor-generator was connected to the busbars at a varying number of degrees out of step without excessive rush of current, as shown by the ammeters.

A paper on "Illuminating Engineering" was presented by Mr. W. D'A. Ryan, of West Lynn, Mass. This was immediately followed by the final report of the 1907 committee to consider specifications for street lighting, of which Mr. Ryan was chairman. This report gave figures from tests which were lacking in the committee report of 1907. On Friday afternoon this report was accepted.

At this point Mr. H. L. Doherty was given the chair in order that discussion on the Commercial Day program might be com-

pleted. The report of Mr. George N. Tidd was discussed, especially with reference to the importance of keeping up active work for new business during the financial depression. The question of co-operation with the contractors was also discussed.

Mr. J. E. Montague, of Niagara Falls, presented a resolution of thanks to the licensed manufacturers of incandescent lamps for their financial support of the Co-operative Electrical Development Association. Mr. F. M. Tait, of Dayton, Ohio, was called upon to report on the subject of "Co-operative Commercialism" in the absence of Mr. J. Robert Crouse. Mr. Tait's report was to the effect that owing to Mr. Crouse's illness, but little could be said. Owing to the recent financial conditions most of the money which had been underwritten was being withheld and the work of the association was at a standstill until conditions were more favorable. Chairman Doherty said that he doubted if any had appreciated the full meaning of the work of Mr. Crouse until recently. He and others expressed themselves to the effect that the work being pushed by Mr. Crouse should not be allowed to languish during his illness. The matter was finally left in the hands of a standing committee on this subject. Resolutions were presented and carried, expressing sympathy and wishes for the recovery of Mr. Crouse. On motion of Mr. Dow, of Detroit, a special vote of thanks was voted to Mr. C. W. Lee and his "numerous, able, vigorous and (thank God) young" assistants who carried out the Commercial Day program. The chairman in closing the Commercial session remarked that when it came to a test of interest as to commercial versus other subjects, the relative attendance in the two meetings this morning proved that the commercial era had been ushered in.

SOLICITORS' HANDBOOK PRIZES AWARDED.

The prizes offered by the Co-operative Electrical Development Association for different sections of a solicitors' handbook were then awarded. These prizes amounted in all to $2600, with interest at 6 per cent from the time the prize money was turned over to the association, making in all over $2700. The Solicitors' Handbook terms of competition divided the handbook into three sections, with first, second and third prizes for each section.

For the light section the first prize of $500 was awarded to a joint production of Messrs. R. Borlase Matthews, of London, Eng., and C. T. Wilkinson, of Schenectady, N. Y. The second prize of $300 in the light section went to Mr. James L. Wiltse, of Brooklyn, N. Y., and the third prize of $200 to Mr. H. W. Hillman, of Grand Rapids, Mich.

In the power section the first prize of $500 went to Mr. Paul H. Bate, of Chicago, Ill.; the second prize of $300 to Mr. C. A. Graves, of Brooklyn, N. Y., and the third prize of $200 to Messrs. Matthews and Wilkinson, of London and Schenectady.

In the heat section the first prize of $300 went to Messrs. Matthews and Wilkinson, of London and Schenectady; second prize of $200 to Mr. James L. Wiltse, of Brooklyn, and the third prize of $100 to Mr. La Rue Vredenburgh, of Boston.

A resolution was adopted expressing appreciation and thanks to the retiring president and vice-presidents, secretary and treasurer, the assistant secretary and treasurer and her efficient office organization. Mr. T. C. Martin, chairman of the committee on "Memorials," reported that suitable memorials would be written covering the following deceased members: Lord Kelvin, W. A. Kreidler, R. C. P. Holmes, Edward R. Coffin, Prof. C. P. Matthews, Hon. E. P. Pagem, Addison F. Hunie, Walter I. Barnes, W. H. Hammond, James Hislop and C. H. Newhall. Mr. Alex Dow presented a resolution which gracefully acknowledged the debt of the association to the Commonwealth Edison Company, Chicago, and its president, Samuel Insull, chairman of the reception committee; to Mr. Louis A. Ferguson, vice-president of the Commonwealth Edison Company, chairman of the entertainment committee; to Mr. Homer E. Niesz, chairman of the hotel committee; to Mr. Frank H. Gale, chairman, and Mr. Walter Newmueller, secretary of the exhibition committee; to Miss Harriet Billings, assistant secretary and treasurer, and to her assistants; to Miss Edith Myers, chief of the registration bureau, and her assistants, and to the *Convention Daily*, conducted under the direction of Mr. C. W. Lee.

ELECTION OF OFFICERS.

The following officers were elected for the coming year: President, Mr. W. C. L. Eglin, Philadelphia, Pa.; first vice-president, Mr. Frank W. Frueauff, Denver, Colo.; second vice-president, Mr. W. W. Freeman, Brooklyn, N. Y.; secretary and treasurer, Mr. John F. Gilchrist, Chicago, Ill. Members of the Executive Committee: For the full term, Messrs. C. L. Edgar, Boston; Alex Dow, Detroit; Arthur Williams, New York; for the unexpired term of Mr. Samuel Scovil, Mr. R. M. Searle, Rochester.

THE NEW PRESIDENT.

Mr. William C. L. Eglin, who has just been elected president of the National Electric Light Association, is well known to most of the members of the association, having served as an officer for the past three years, during two of which he acted as secretary and treasurer of the association. Although this office is an honorary one, it was developed in his administration to one of great activity. Many changes were made in the organization and the system of carrying on the increased work of the association, on account of the rapid growth in its membership and the many new and important subjects requiring the association's attention. Mr. Eglin has also served on a number of important committees of the association, notably the steam turbine committee and the gas engine committee, both making exhaustive reports. His active business experience has been in connection with the various electric lighting companies in Philadelphia. He became connected with the Edison Electric

PRESIDENT W. C. L. EGLIN.

Light Company of Philadelphia in 1889, and later with the various consolidated companies culminating in the Philadelphia Electric company, which owns and operates all of the electric lighting companies in the city and county of Philadelphia. He is at present the electrical engineer of this company.

Mr. Eglin has contributed many articles on important technical subjects to the American Institute of Electrical Engineers and to the technical press. With the work of the institute, he has long been identified, having served as chairman of the Philadelphia branch, and he is at present one of the vice-presidents of the institute.

He was, for a number of years, active in the work of the Engineers' Club of Philadelphia, having served on its board of management, as chairman of the information committee and as vice-president. He is a member of the Engineers' Club of New York, the American Electrochemical Society and the Illuminating Engineering Society. He has also served on various committees of the Franklin Institute of Philadelphia.

He is also a member of the prominent clubs in Philadelphia—Union League, Merion Cricket Club, Manufacturers' Club, Bryn Mawr Polo Club, Pen and Pencil Club, Aronimink Golf Club and Magnetic Club; and of the Mohawk Club, Schenectady, N. Y.

Convention Notes.

The Secretarial Work of the convention was unusually well done, due in large measure to the fact that Mr. W. W. Freeman, the secretary, has given unremitting attention to the affairs of the association throughout the year, meeting President Farrand at the New York headquarters at least once a week. As the new secretary, Mr. J. F. Gilchrist, is located in Chicago, it may prove difficult, however, to maintain this plan. All the general convention work was as usual in the capable hands of Miss Harriet Billings, the assistant secretary, whose well-drilled staff, supplemented by a large corps from the Commonwealth Edison Company, made things move with entire smoothness and satisfaction. Miss Edith M. Myers was as usual in charge of the registration bureau, issuing badges, etc., and in her efficient discharge of this task was assisted by some very competent and pretty young women, students in the university.

A Murray Luncheon.—A beautiful luncheon party was given in honor of Mrs. T. E. Murray on Friday, before her return to New York with Mr. Murray, the well-known vice-president of the New York Edison Company. A big table at the Auditorium Annex was covered with American Beauty roses and broad red ribbon, and around it sat a score of friends, including President and Mrs. Dudley Farrand, past Presidents Doherty, Blood, Davis and Williams, Mr. and Mrs. Alex. Dow, Mr. and Mrs. W. W. Freeman, Mr. and Miss Eglin, Mrs. L. A. Ferguson, Mrs. J. B. McCall, Mr. N. F. Brady and Mr. T. C. Martin. Several appropriate toasts were given.

A Thomson-Houston Reunion.—A movement was started during the N. E. L. A. convention to bring about a reunion of the men who used to be employed by the old Thomson-Houston Electric Company. The movement was given such an impetus by the members of the "old guard" present that it is now planned to have a general meeting of the men still living who were associated with the Thomson-Houston Company at any time from its inception until it was absorbed by the General Electric Company. In order to make it possible for all, no matter in what capacity they were employed, to take part in the event, it is planned to hold the meeting in January of next year coincident with the Chicago Electrical Show. The object of calling together the old "boys" formerly engaged by this pioneer corporation is purely social, but it is expected much good will come to the participants. In order that some idea may be obtained of the number of persons that may be expected to join in the reunion, it has been suggested that each one employed by the Thomson-Houston Company up to the time of its absorption send his address to Mr. George Cutter, South Bend, Ind., who will keep the name and address on file. Any suggestions on method of procedure, plans, etc., that may be made will be given careful attention. On the number of letters received will depend the preparations that are to be made for the event.

A Convention Tragedy.—It may be considered remarkable that holding over 30 conventions and visiting every part of the country, the association has hitherto escaped any serious disaster or tragedy in connection with any of its members. Last week that happy record was broken and marred by the assassination of Mr. R. C. P. Holmes, the amiable and popular purchasing agent of the Commonwealth Edison Company, who had been most active and energetic in the entertainment of members, to many of whom he was a warm personal friend of 20 years standing. After a dinner of the purchasing agents on Wednesday evening, and chatting till about midnight with members, of whom the present writer was one of the last, he left the hotel for home, only to be murdered and robbed of all his valuables, before he had gone more than a few blocks. Consternation and grief prevailed next morning when the sad news was known, and as a tribute to his memory, the convention adjourned as a body on Thursday morning, and did not reassemble until the afternoon. Mr. Holmes was a pioneer in the central station field, and had been in Chicago from the early days of the Western Edison Company, growing with it until at the time of his death he had a position of great responsibility. None who knew him will forget the bluff, kindly Englishman, whose end was the more tragic that it came in the very midst of the generous hospitality that he loved to extend.

The Rochester Delegation.—Mr. R. M. Searle, general manager of the Rochester (N. Y.) Railway & Light Company, had with him a party of no fewer than nineteen members of his official family. So large a delegation attracted considerable attention, and when inquiry was made of Mr. Searle on the subject, he said: "If you want an analysis of my reasons for bringing so large a delegation to the meeting, I would say: 'First of all, I know the great value of association work, and I also know that I can get the enthusiasm here engendered into each man who is in direct contact with the public. Every man on a staff must be well trained, and he cannot be up-to-date unless he is abreast of the art. Now, nineteen men, each saturating himself with that which appeals most to him, can disseminate it in turn with profit to his own force of employees, especially when he thus gets it at first hand. Each man with me here is the head of a department. I cannot secure one man at a salary equal to the combined expense of these nineteen men, who could or would individually distribute the beneficial instruction derived from the association through nineteen company channels. In other words, I get results from nineteen trained men, nineteen times as quickly and nineteen times as effectively as I would from just one or two. At first glance it may look extravagant, but it is the highest economy. I could already tell you of good secured that would pay the cost of the entire trip.'"

Power Plant Garden Party.—On Wednesday afternoon a most delightful visit was made to the Fisk Street turbine power house of the Commonwealth Edison Company, on the banks of the Chicago River. This stately plant was fully described in the May 16 issue of the Electrical World, but no article can do justice to the care and thought bestowed on it, or to the completeness and beauty of the whole. It is a great cathedral, devoted to the religion of power, and a feeling of worship is inspired by the gigantic machines, the towering walls, the long-drawn aisles. Hundreds of visitors, received graciously by President Insull and his staff, wandered all over the place, admiring something new at every turn, and then were escorted out on to a broad green lawn, skirting the river, where, with exclamations of surprise, they found a huge marquee, quite in garden party fashion, where five o'clock tea and other refreshments were served. Each visitor took away a handsome pamphlet telling the story of the plant, with pictures, and including the reproduction of a photograph taken when the association held its previous meeting at Chicago in 1903. At that time the building was in process of construction, and many members thought it rather ambitious, but the foresight of the management was justified, for it now contains 10 units of 110,000-kw capacity, and now another station is being built just across the river to be known as the Quarry Street Station. As Mr. Insull stated, not alone is the system keeping pace with the growth of population, as to number of customers, but of late it has taken on new loads in great big blocks of thousands of kilowatts, for railway service and the like.

The Exhibit Organization.—The Class D member of the N. E. L. A. met in the green room of the Auditorium Annex at 4 o'clock, Thursday afternoon, and unanimously re-elected the present exhibition committee for the ensuing year. The committee, which was elected on Dec. 6, 1907, and which had charge of this year's exhibits, is composed of Mr. F. H. Gale, General Electric Company; J. C. McQuiston, Westinghouse Companies; Mr. H. S. Heger, Allis-Chalmers Company; Mr. Rodman Gilder, Crocker-Wheeler Company; Mr. H. M. Post, Western Electric Company; Mr. C. P. Frey, Weston Electrical Instrument Company; Mr. Benj. Wall, Metropolitan Engineering Company; Mr. James I. Ayer, Simplex Electric Company, and Mr. S. E. Doane, National Electric Lamp Association. A set of by-laws, which had been carefully prepared by the com-

mittee, was adopted. The by-laws provide for nearly every contingency that may arise and give the committee a basis upon which to work. During the early part of the meeting the chairman reviewed the work done by the committee, which it was stated had been entirely in harmony with the work of the association. As an expression of the exhibition committee's appreciation of the untiring efforts of Homer E. Niesz, of the Commonwealth Edison Company, a beautiful traveling bag was presented to him. Mr. Niesz acted this year as a local member of the committee and was instrumental in effecting the arrangements which made the exhibition a success. Mr. C. A. Tupper, Allis-Chalmers Company, who had charge of the placing of the exhibits in the exhibition hall, was given a vote of thanks for the efficient way in which he did the work, and a vote of thanks was also extended to the management of the Chicago Electrical Show for the loan of exhibit hall fixtures. The report of the treasurer, which was read, showed Class D, which represents the supply members of the association, to be in a healthy financial condition.

THE WHITE CITY.—On Tuesday evening the members of the convention, one thousand strong and weak, visited the White City, the lakeside summer resort of Chicago, and opened its season, admiring greatly its lavish illumination.

LUNCHEONS AND DINNERS were given during the week by Mr. and Mrs. Insull, Mr. and Mrs. Freeman, Mr. and Mrs. Farrand, Mr. F. W. Willcox, Mr. R. D. Lillibridge and others. One of the most interesting affairs of this kind was the Stone & Webster luncheon at the Midday Club, when 24 members of the organization assembled under the leadership of Mr. W. H. Blood, Jr., past president of the N. E. L. A.

SONS OF JOVE.—This genial and congenial body of men delighting in mingled mystery, mischief and magnetism, and all devoted to the promotion of electrical development held a "rejuvenation" on May 20, at the Auditorium, attended by over 200 members. No fewer than 23 candidates were admitted. Then a banquet was served over which Mr. J. E. Montague presided. The Sons went home in the cold gray dawn of the morning after, but were all on hand for the opening of the business sessions.

PICTORIAL BREAKFAST FOOD was the clever description of the cartoon given by Mr. John T. McCutcheon in his lecture on caricature before the ladies of the convention on Wednesday afternoon at the Art Institute. A very clever and interesting talk was given, every point being emphasized by a sketch on the blackboard, and this was supplemented by a number of offhand delineations of leading members of the association. Afternoon tea was then served in the Rembrandt room, presided over by Mesdames Farrand, Insull, Ferguson, McCall, Dow, Freeman, Donohoe and Eglin, and accompanied by Tomaso's Mendelssohn Orchestra.

A CHICAGO STORE.—A quite unique entertainment was provided for the ladies—and some of the men—in a luncheon given at the famous store of Marshall Field & Company on Wednesday. A tour of inspection was made of the establishment, whose magnitude may be inferred from the fact that there are no fewer than 300 managers of separate departments, and special attention was paid to the scheme of lighting, Nernst lamps being used throughout, giving, so far as opinions could be elicited, very thorough satisfaction. The luncheon was exquisite in quality and service, giving a further idea of the resources of the industry on which that commercial genius, Marshall Field, stamped his imprint so deeply.

THE THEATER PARTIES.—On Thursday evening the attendants at the convention were entertained by the local committee at two theaters. One large party witnessed the performance of Elsie Janis in "The Hoyden," and another saw Christie McDonald in "Miss Hook of Holland." What are known as "gags" were plentifully distributed throughout the dialogue of both pieces, and no guilty author of convention paper was allowed to escape; while references to electrical conditions, local and national, were brilliant and bristling at every turn. The honors of the occasion rested with Mr. Doherty, who was not satisfied with being roasted in song and story, but insisted on bearing away with him from the theater the one trophy of a very pleasant evening. A sketch of it would make an appropriate tailpiece for the Chicago transactions.

CO-OPERATIVE DEVELOPMENT.—Never were more sincere regrets expressed at the absence of a member than were those heard on every hand in regard to Mr. J. Robert Crouse, Jr., whose program of co-operative electrical development has literally revolutionized the lighting and power industry in the last three years and given it a stimulus beyond estimation. He has broken down under the burden of his splendid aims and ambitions, all unselfish and for the common good, and it is simple truth to say that no other young man has ever come forward in the electrical field so determined as he to promote the use of electricity. His return to health and activity will rejoice a host of friends and admirers of Mr. Crouse, who with every temptation to the enjoyment of life on its easy side, has sacrificed everything to the pursuit and achievement of a lofty idea.

VISITING PRESIDENTS.—Among the presidents of other electrical bodies attending the convention were Mr. J. R. Strong, head of the National Electrical Contractors' Association, and Mr. A. C. Lindemuth, of the International Independent Telephone Association, which has its headquarters in Chicago. The latter organization is growing rapidly, and Mr. Lindemuth, with the help of Secretary Harney, made a thorough expert study of the N. E. L. A. methods of handling convention badges, passes, papers, registration, committees and other items, with a view to the adoption of some of the features at the next telephone convention. Another president in attendance was Mr. L. A. Ferguson, whose election by the American Institute of Electrical Engineers, was greeted with great enthusiasm on Tuesday night. He received 1766 votes, the largest number ever cast for an institute presidential candidate.

AN ELECTRICAL TRANSITION.—Originally a telephone engineer, Mr. B. E. Sunny, who for at least a score of years past has had charge of Thomson-Houston and General Electric interests in Chicago, has gone back to telephony, and the present convention served as the psychological moment of his atavism. It was his success in telephony that first attracted attention, but it is easy to understand that the pulling forces in two different directions have given Mr. Sunny some anxious moments during the last few months. The Bell telephone system has gained a valuable representative, but it must have given Mr. Sunny a heart-strain more than once as old friends in the lighting industry came up to him and told him how sorry they were to think they would not see him now as much as in the old days. Mr. Sunny has already become president of the Chicago Telephone Company and vice-president of the American Telephone & Telegraph Company, and even last week found his new duties so overwhelming that the convention saw all too little of him.

AUTOMOBILE TRIP.—Through the courtesy of the Board of Governors of the South Shore Country Club, the ladies attending the convention were invited by the N. E. L. A. to a luncheon at the club on Thursday. Automobiles were provided by the association to take the ladies through the south boulevards and parks to the club. More than 200 ladies accepted the invitation. The start was made from the Auditorium at eleven o'clock. The weather was perfect and the parks wore their prettiest spring gowns, decorated with lilacs, azaleas and other blossoms to welcome the party and vie with them in their beauty. Arrived at the club, the ladies were able to enjoy the lake breezes wafted across the lawns and flower beds which, together with the ride, bestowed upon every one an appetite for the delicious luncheon which was served in the clubhouse. In the afternoon the automobiles were placed at the disposal of the ladies for a couple of hours' drive through the parks, and the party arrived back at the hotel at five o'clock. Mr. John J. Schayer and Mr. Godfrey H. Atkin had charge of the arrangements, and the ladies were enthusiastic in their thanks and appreciation of the excellent manner in which the committee had provided for their comfort and entertainment.

Discussion of N. E. L. A. Papers.

Our issue of last week contained abstracts of papers read at the convention of the National Electric Light Association, held in Chicago during last week. Below are given accounts of the discussions following the presentation of these papers:

GAS ENGINES.

An interesting discussion was brought out by the reading of the report of the Committee on Gas Engines, of which Mr. W. C. L. Eglin was chairman. (See page 1102 of our issue for May 23.)

Prof. Charles F. Lucke called attention to the recently-organized gas-power section of the American Society of Mechanical Engineers, which takes up technical questions of detail in connection with gas engines. Those interested can join this section and receive its proceedings for $5 per year without becoming a regular member of the A. S. M. E. He called attention particularly to the point that the gas engine does not vary in efficiency with the size of the unit in the same proportion that a steam installation does. In a station of 20,000 kw and over, he doubted whether gas will produce energy at a lower cost than steam. On the other hand, he had no doubt of the ability of the gas engine plant in small units to make more money than other plants. Gas-engine installations will earn most in proportion to competitors when the cost of fuel is high and when the individual load factor is high. The load factor influences the fixed charges. A gas-engine station should not be as much subdivided as to units as a steam-engine station, because the economy of the gas engine on light loads is generally better in proportion to full-load economy than that of the steam engine.

Mr. J. R. Bibbins said that American practice with reference to producers will not be satisfied until there are improved methods of mechanically removing the ashes, and methods whereby the producer supplies its own steam or vapor and completely eliminates tar. If a holder is to be used, it should be for the purpose of equalizing the quality of the gas, not for storage. In an 800-hp plant at Bradford, Pa., the average cost of repairs during the last nine years when the plant has been in operation has averaged 0.89 per cent of the value of the engines. This result shows the possibilities when a plant is kept in good order under intelligent supervision.

Mr. Harold Almert spoke on the results of gas-engine practice up to the present time, and said that the gas engine has not been a very satisfactory source of energy as yet, owing partly to the difficulty of getting the proper kind of man to look after it.

Mr. R. M. Searle, of Rochester, said that nearly all of the failures of gas engines installed are due to employing incompetent men to take charge of them. The gas engine requires high order of intelligence, because it is essentially a complicated machine.

Mr. H. L. Wills, of Savannah, who spoke along the same line, remarked that those investigating gas engines should not pay so much attention to the engine, but a little more to the engineer.

Prof. Lucke said that it is easier to train an intelligent machinist to run a producer than it is to instruct an experienced steam engineer.

TUNGSTEN LAMPS FOR STREET LIGHTING.

In the discussion of the paper by Mr. P. D. Wagoner, of Schenectady, on the foregoing subject, which was abstracted on page 1103 of our last issue, Dr. C. P. Steinmetz said that it is interesting to note that even though the tungsten lamp shows such good efficiency in comparison with other illuminants suited to lighting suburban and residence districts, there is even in this case a slight advantage shown by the luminous arc over the incandescent lamp in efficiency of light production. The luminous arc, whether of the magnetite or titanium types, or the flaming-carbon type, is superior in efficiency to the tungsten incandescent lamp. The superiority of the incandescent lamp for certain kinds of outdoor illumination must be found in the ability of the incandescent lamp to be used in smaller units. The great handicap of the arc is that it is a large unit. Where very high brilliancy of illumination is required, the incandescent lamps will never be able to compete with the luminous arc. Each illuminant, therefore, has its legitimate field in which it cannot be beaten by the other. It would be regrettable if engineers were to be scared off from the use of tungsten lamps by comparing the photometric output in candle-power per watt of the tungsten lamp and the luminous arc. Comparing the different incandescent lamp units, the old carbon-filament lamp expense of illumination was mostly the cost of energy and a very small part of it for lamp renewals. In the tungsten lamp the main part of the cost is for lamp renewals. With the tungsten lamps and the possibilities in the future development of these lamps, the doom of the Welsbach mantle seems to be close at hand.

Mr. V. R. Lansingh called attention to the possibility of wasting less light among the trees and against the nearest houses and redistributing the light so as to throw a larger percentage lengthwise of the street. This result is being accomplished in the city of Washington.

PHOTOMETRIC ACCURACY.

In connection with the paper of Dr. A. E. Kennelly, and Mr. S. E. Whiting on photometric precision, given in abstract on page 1104 of the May 23 issue, Mr. J. B. Klumpp, of the United Gas & Electric Company, said that this paper tends to belittle the accuracy of observations by the Bunsen or Leeson disk. Readings by the inexperienced will probably be more in error with a Bunsen-Leeson disk than with a contrast photometer, but he believed the observations can be made by an experienced operator just as accurately as with the contrast photometer. He had known many observations between gas and pantane lamps where the color is practically the same and where the observations of different readings had been within from ¼ to ½ per cent for a series of over a thousand readings. The same readings were produced a month later with an accuracy within the same percentages.

Mr. Preston S. Millar, of the Electrical Testing Laboratories, considered that the errors obtained in the tests reported were larger than might be considered typical for observers in constant practice. To substantiate this a test was made at the Electrical Testing Laboratories in New York, following the methods outlined in the paper. With a Bunsen photometer having a Leeson disk instead of a grease spot, the probable error for a single setting in a series of 25 was .4 per cent instead of 1.5 per cent, as stated in the paper. With the contrast Lummer-Brodhun photometer, the error was .24 per cent instead of .46 per cent, as given in the paper.

LOW-PRESSURE STEAM TURBINES.

In discussing the paper by Mr. J. W. Kirkland, abstracted on page 1102 of our issue for May 23, Mr. W. L. R. Emmet called attention to the fact that the great advantage of the low-pressure turbine is that it is better than the condensing engine, and its most valuable field is that now occupied by the condensing engine, the low-pressure turbine and condenser being substituted for the present condensing equipment without changing the engine equipment proper. He made the rather startling assertion that while the Fisk Street station of the Commonwealth Edison Company (which the convention was to visit that afternoon) was producing energy at the largest rate and at the lowest cost at which it has ever been produced through the application of turbines, nevertheless there is no engine station in the country which cannot by the use of low-pressure turbines obtain a steam consumption rate practically as low as that at the Fisk Street station. The reason for this, as explained in Mr. Kirkland's paper, is that the engine is inefficient at low-pressure ranges, whereas the turbine is highly efficient throughout this range. Steam turbines generally operate better in the larger sizes because the fixed losses in the high-pressure ranges are very great, and small turbines, unless they can be run at excessive speeds, are relatively inefficient. However, the low-pressure turbine in the small sizes is practically as efficient as in the larger sizes because its rotor moves in an

atmosphere very highly attenuated, and the friction loss is small. Consequently, a 300-kw or a 400-kw engine can exhaust into a low-pressure turbine and thereby greatly decrease the water rate. The ease of obtaining vacuum has also been improved, because with this combination the steam will be delivered to the turbine at a pressure above atmospheric, and consequently no air leaks into the engine. The reason why the vacuum in the reciprocating engine is often poor is that the engine sucks air at every stroke, and a very small amount of air renders high vacuum impossible. With the reciprocating engine a high vacuum is not sufficiently valuable to make it worth while to take special precautions to preserve it. In a turbine, a high vacuum is very valuable and all losses should be avoided. Very often the existing condenser will produce a high vacuum if a turbine is used between the engine and the condenser.

GROUNDING OF SECONDARIES.

The report of the committee on the grounding of secondaries, which recommended the adoption of a resolution favoring the insertion in the National Electrical Code of a rule requiring that secondary circuits be grounded where the difference of potential between any conductor and ground would be less than 150 volts, and prohibiting grounding where this difference of potential would be in excess of 150 volts, was noted on page 1104 last week and commented on editorially.

In discussing the report, Mr. H. B. Gear, of the Commonwealth Edison Company, Chicago, said that it did not state the reasons why the maximum potential between one wire and ground was limited to 150 volts rather than 250 volts. The recommendation of the committee permitting only 150 volts would prevent the grounding of secondary circuits of 220-volt motor users. Such customers are entirely too numerous to be left out of account, and they should be protected as much as the lighting consumers. A No. 4 ground wire, as suggested by the report, is unnecessarily large, as a No. 6 in many cases will answer all purposes.

Mr. J. W. Cowles, of Boston, said that the matter of requiring the grounding of secondaries had been delayed too long. In Boston the grounding of secondaries is required as a part of each consumer's installation. Ground connections are usually made to water pipes. He favors the protection of the ground wire in exposed places by an iron pipe rather than by a wooden molding. The theoretical disadvantages of greater inductive effect with the iron pipe is less than the practical advantages offered in mechanical protection against injury.

The resolution of the committee was unanimously adopted.

ENERGY DISTRIBUTION IN SUBURBAN DISTRICTS.

The discussion of the paper by Mr. Geo. H. Lukes, which was noted on page 1103 last week, was opened by Mr. Farley Osgood, who remarked that it seems hardly necessary to discuss the matter of frequency for transmission or suburban distribution work, 60 cycles being the proper frequency for lamps and motor work. Even when street railway work is to be done 60-cycle rotary converters can be used with safety. However, the existence of a heavy proportion of railway load might warrant 25-cycle equipment. Where transmission pole lines carry low potential circuits as well as high-tension circuits it is good practice to have the lower cross-arms separated by at least 40 in., thus making it safe for men to work on the low-potential wires. Porcelain insulators are, without question, better than glass, and owing to the recent combination of the glass insulator manufacturers, they can be obtained for an equal or lower price.

In the East the use of angle-iron arms in addition to iron pins on wooden poles is being introduced. The number of poles destroyed by fire from electrical causes on lines using this type of construction is remarkably low. He emphasized the necessity brought out by Mr. Lukes for building substations of sufficient size to take care of future requirements. Lack of this consideration has cost lighting companies as much money during their periods of growth and attending reconstruction as any one weakness on the part of the men responsible for the welfare of the companies. Some of the larger companies have a prognostication department, which makes studies of future development of localities for a period of 25 years.

As to local distribution, the usual practice in the East is to distribute energy locally by two-wire single-phase, except for large motor users, in which case the four-wire two-phase scheme is used. Orinarily it is undesirable to connect motors of greater than 10 hp rating on a single-phase lighting circuit, although in the territory which has a small day lighting-load, as large as 20 hp can be used with safety. He favored the placing of secondary wires on the lowest cross-arm as the safest for circuits on which work is continually being done by linemen.

He said that a pipe driven in the ground does not make a satisfactory ground connection; neither does a copper plate surrounded by charcoal. His company feels that the only method that can be used with security is grounding to water mains or service pipes near the main. It is better to go to considerable expense in running overhead ground wires to obtain a water-pipe ground connection rather than to accept any other kind.

Distribution losses should be watched most carefully in such a way that they may be anticipated and the necessary reinforcements to circuits be made before complaints are received from customers. He urged the importance of obtaining clear and legal right-of-way permits from abutting property-owners for pole lines. Many companies are lax in getting these, because at the time a pole line is built no objection is raised.

Mr. Peter Junkersfeld said that companies frequently are tempted to overload street pole lines run in streets primarily for street lighting purposes by putting on them wires for general energy distribution purposes. If alleys are available in some cases it is desirable to build the principal lines in the alleys, thus duplicating pole line investment to a certain extent for the sake of preventing agitation for placing wires underground. It is well to be very careful in street lines not to get them loaded up so heavily that the company will be forced to place its wires underground, when by a little foresight this requirement will be postponed. In generating stations attention can be concentrated on the design when they are built, but pole line extension goes on from day to day as a matter of routine work and for that reason is likely to be handled carelessly.

Mr. H. B. Gear agreed with Mr. Osgood that the water-pipe system should be used for the grounding of secondaries whenever it is available, but in Chicago the places where the water pipes are available are so few that it is absolutely necessary to provide other means for getting a ground connection. After several years' trial of both copper plates buried at the base of the pole and of galvanized iron pipes driven into the ground, it was found that the galvanized pipes afforded fully as good and in many cases better ground connections than the copper plates, the galvanized pipe being far cheaper to install. The nature of the soil affects the resistance of the ground in different places. It is therefore necessary to make tests in different parts of the city to ascertain what can be done and how many ground connections are required. In some outlying places where water pipes are not available, two connections are installed. He thought two ground connections good for any overhead secondary system, because a ground wire is likely to be accidentally broken or cut.

As to the four-wire three-phase system for energy transmission lines, the entire load in South Chicago, which is from 500 to 600 kw,, seven miles from the nearest 60-cycle station, is carried on a four-wire three-phase line regulated at the station, no attendant being kept at the receiving end. A substation building was provided only for the housing of transformers and as headquarters for trouble men. The same thing is done in another locality. The voltage regulation secured in these circuits by this means is as good as from the 2200-volt, four-wire feeders transmitting energy directly from the substation. The phases may be very much unbalanced, and yet the regulation is as good as when balanced. Therefore, the four-wire, three-phase system for transmission purposes as well as for distribution has some great advantages over the three-wire, three-phase system.

Dr. C. P. Steinmetz criticized the transmission line construction shown in Mr. Lukes' paper, which does not provide an overhead grounded wire above the transmission wires. In a system using this construction, extending over considerable territory where thunderstorms are frequent, it becomes almost impossible to guard the system from disturbances from lightning. A customer obtains an unsatisfactory impression if he must prepare to use candles whenever a thunderstorm threatens; that is the case with many transmission lines. He also spoke of the common practice of operating with two transformers connected in open-delta on a three-phase circuit. While this is satisfactory for operating a small motor at a primary e.m.f. of 2200 volts, it is a dangerous combination to use on e.m.f.'s above 2200 volts. This combination is liable to high-voltage disturbances of mysterious origin. In the last year he has heard of more trouble from the use of two transformers connected in open-delta on a three-phase system than from all other causes combined. It is far safer to use single three-phase transformers if one does not wish to use three transformers.

ECONOMICAL OPERATION OF THE SMALL CENTRAL STATION.

In discussing the paper by Messrs. J. C. Whittlesey and Paul Spencer (see page 1104, May 23), Mr. C. M. Young, of Columbus, Ga., said that the station engineer may not be very energetic or realize the importance of determining the unit cost of production, but once it is determined, he is more likely to become enthusiastic about small economies to reduce them. It is an excellent idea for small stations to engage a consulting engineer from time to time to analyze their conditions and show where they can be improved.

Mr. C. A. S. Howlett described a 75-kw central station in a very small town which gives day service. The engine arrangement is unusual, a small engine being attached by a clutch to one end of the generator shaft, and a large engine to the other end. The small engine is run during hours of light load.

Mr. T. W. McNamee, of Wabash, Ind., said that in the station in which he is interested an accurate daily record of the evaporation per pound of coal proved to be of great value. The variation with different kinds of coal, which were supposed to be of good grade, were found to be from 6.5 lb. to 8 lb. of water evaporated per pound of coal. Without the evaporation record they would not have known what results the coal was giving. To measure the water supplied to the boilers a small pump is attached to the feed pump so as to make the same number of strokes as this pump. The small pump, which is of one-tenth the size of the feed pump, forces cold water from a tank through a meter and back to the tank again. By applying a constant reading of this cold-water meter the amount of boiler feed is determined. The cold-water meter can easily be calibrated by actual measurement of the water passing through it.

Mr. Harold Almert, of Wichita, emphasized the necessity of connecting and disconnecting boilers and engines at the proper time. In small plants boilers and engines will be operated up to their normal rating, but about the time they begin to show economy by virtue of being operated at nearly full load, additional units are started, thereby decreasing the economy. Engineers and firemen operate the equipment in this way because the boiler pressure can be allowed to vary between wider limits without making trouble, and in general the machinery need not be as closely watched. In one station a saving of 40 per cent was accomplished by simply working the boilers and engines nearer the rated full load.

Mr. R. M. Searle, of Rochester, pointed out that obtaining maximum economy in a boiler plant necessitates always burning the number of pounds of coal per square foot of grate which will give the maximum amount of carbon dioxide in the flue gases. To do this, it is necessary to employ a small grate surface on light loads, otherwise an excess of air goes through and practically the boiler is being heated with hot air.

Mr. Whittlesey agreed that it is undoubtedly more economical to force boilers up to as high an output as possible for a couple of hours rather than to use additional boilers.

MOTOR LOAD FOR SMALL STATIONS.

The discussion on the paper by Messrs. Robbins and Bibbins, an abstract of which appeared on page 1103 last week, was opened by Mr. F. L. Dame, who said that the tendency of solicitors is to install motors that are too large for the class of service required in alternating-current work. The motors then operate at a low-power factor and a fictitious load is put on the generating apparatus which cuts down the useful output. Mr. N. T. Wilcox, of Lowell, said that some stations are already trying to protect themselves and are adding a certain definite amount to the service-charge for every per cent that the power factor falls below 80. This plan makes it an incentive to the consumer to keep the wattless current at a low value.

Mr. Paul Spencer said that practically every motor installation is provided with excess rating in machines and the company should insure that the consumer is not installing too large motors. One way to prevent this is to put a penalty, not on the low-power factor, but to require a minimum or fixed charge per horse-power on the motor itself so as to induce the consumer to use the smallest possible size of motor that will handle his business.

Mr. J. M. Cranford, of Jasper, Ala., said that he lived in a town of 2500 people and is rendering day service throughout the whole year. The small motors, such as for fans, sewing machines, etc., help out the load. The company wishes to supply more energy to motors, and is not concerned much about their size or power factor.

Mr. J. S. Cartwright, of Knoxville, spoke of having secured the co-operation of the motor manufacturers to the extent of getting motors loaned on trial for several months. He also suggested that a central station should co-operate with a good live contractor in the town. While his company does not run a sales department, it carries 3-hp, 7-hp and 10-hp motors in stock most of the time, so as to have them available if anyone wants to make a trial.

REPORT ON METERS.

A committee, consisting of Mr. L. A. Ferguson as chairman and Messrs. Alex. Dow and J. E. Montague, submitted a report relating to some of the developments in meters during the past year. Notes were made of so-called "watt-demand" indicators with which watt-hour meters must be used to measure energy, and of recording wattmeters which may be used simultaneously as a maximum demand indicator and an energy meter by integrating the area of the chart to obtain the value of the watt-hours. The committee called attention to inaccuracies in watt-hour meter records that may be caused by external fields, stating that an error of from 5 to 10 per cent may be produced by placing direct-current watt-hour meters too close together.

In the discussion, Mr. Geo. A. Sawin expressed the opinion that the values for errors given in the report represent the maximum rather than the probable values. Mr. S. M. Bushnell, who was responsible for the tests upon which the report was based, said that the values referred to maximum errors.

Mr. Alex. Dow, in discussing the importance of testing meters in position, said that the fact that meters register correctly in the laboratory does not prove that they will operate correctly on the consumer's premises.

UNIFORM SYSTEM OF ACCOUNTING.

A committee, consisting of Mr. H. M. Edwards as chairman and Messrs. E. J. Allegaert, E. W. Brundrett, John L. Bailey and Frank L. Dame, submitted a report outlining a system of accounting for electric lighting companies. The following classification was made of expense accounts, the scope of each class being indicated: Production, cost of electric energy delivered to station terminal board; transmission, cost of conducting energy to substation and delivering it to the distributing system; storage battery, cost of storing energy; distribution, cost of conducting electric energy from substation terminal board to customer's premises; municipal street lighting, cost of operation of street lighting system; commercial expense, all office expenses in connection with customers' accounts; new

business, cost of securing new business; general administration and miscellaneous expenses.

The report was discussed by Mr. J. B. McCall and Mr. R. S. Searle, both of whom favored the classification proposed by the committee. The report was adopted unanimously.

AMENDMENTS TO CONSTITUTION.

Mr. H. L. Doherty, as the committee on organization, presented a report suggesting certain changes in the constitution in order to render the National Electric Light Association the basis for a complete organization of the entire central station business of the country. Acting upon the suggestions made in Mr. Doherty's report, a committee, consisting of Mr. W. W. Freeman, as chairman, and Messrs. L. A. Ferguson, Arthur Williams, F. M. Tait and W. H. Blood, Jr., recommended amendments to the constitution according to which exhibitions and contests under the officers of the N. E. L. A. may be held at places designated by the executive committee, local sections of the N. E. L. A. may be formed in any State and a company section may be organized by any Class A member company from its employees, provided they are members of the N. E. L. A. Moreover, the executive committee is authorized to call a national conference upon any designated subject when requested to do so by 15 Class A member companies. The recommendations of the committee as outlined above were adopted.

New Telephone Patents.

TRAIN SIGNALING SYSTEMS.

For a long time there has been discussed at frequent intervals the possibility of establishing telephone communication between trains scattered along a section of railroad and the signal towers. Some of these systems have contemplated a continuous means of communication between moving trains and stationary points, while others have merely contemplated the setting off of a signal which will notify the engineer to stop and call. Patents for two systems have been issued, one of each kind.

The system of F. L. Odenbach, of Cleveland, Ohio, is of the former class. He provides an overhead trolley wire above the railroad track with a trolley secured to each train in contact therewith. Upon each train he includes a source of potential, such as a generator or battery, which is in circuit with a commutating device driven continuously by an axle of the train. His signaling devices comprise an indicating instrument of the galvanometer type and an incandescent lamp. The generator of each train is so connected to the trolley and track that if a short-circuit or another train comes within a predetermined distance controlled by the voltage of the system a flow of current will be indicated upon the lamp and by the motion of the galvanometer. Under a short-circuit the lamp in the cab of a train will be flashed by its own commutator under the influence of its own generator only, while when two trains come within the danger zone the currents supplied to the rail and trolley by the two trains will overlap, causing a peculiar variation of the signal, from which can be interpreted the relation and motion of the trains. Switches are provided by which the signaling apparatus may be cut out and telephone apparatus substituted in the circuit, so that the engine men may communicate with each other over the trolley wire.

The second system is the invention of E. Sughroue, of Bartley, Neb. He employs the telephone lines, now so frequently running along the railways for despatch and other purposes, to convey his talking currents. In addition, the operation of the signals requires a special wire. Distributed along the right of way are rocket boxes, the ignition of the rockets being under the control of percussion caps. A group of these rockets is connected up in series to a single signal circuit. When it is desired to stop a train on one of these sections, current is sent over the signal wire, operating at each rocket box an electrical trigger in the shape of a vibrator. This trigger explodes the caps, fires the rockets and signals the engineer to call up on the telephone line. A further feature of the rocket box is a trip bar, which is set upon the explosion of the rocket, which trip bar is designed, through a linkage, to trip the throttle lever latch in the cab and thereby shut off the steam, in case an attempt is made to run by the signal.

SWITCHBOARD CIRCUITS.

The Dunbar two-wire type of central energy system, in which a controlling relay serves to disconnect a subscriber's line from the signaling apparatus, and simultaneously connected to the switchboard jacks, is well known and has been used with many variations.

C. A. Simpson, of Chicago, Ill., has adapted this main principle to a three-wire system, his control relay being connected to the third, or sleeve, contact of the jacks, the third strand of the cords serving to furnish current for this control relay. This system definitely separates the busy test and signaling circuits from the talking circuits, while the other features are practically exactly those of the Dunbar type. Mr. Simpson has assigned his patent to the Kellogg Switchboard & Supply Company.

Another patent assigned to this company is one recently issued to E. H. Rupe, of Chicago, Ill., for a thorough ringing trunk circuit for use between toll boards and switchboards of the two-wire Dunbar type. With this class of service it is desirable to have the toll operator control all ringing, the switching operator merely connecting the desired subscriber to the trunk. With this end in view a ringing relay is provided in the trunk, which serves in lieu of a ringing key. There is also provided a ringing control relay, which normally holds the ringing relay circuit severed. The toll operator, by means of a ringing key, puts a ground upon the trunk circuit in such a way as to release this ringing control relay during the depression of the key, thereby causing through the ringing relay a signal upon the desired line.

LETTERS TO THE EDITORS.

Overshooting of Tungsten Incandescent Lamps.

To the Editors of Electrical World:

SIRS:—I have read with interest the articles by Mr. John B. Taylor on the "Overshooting of Tungsten Incandescent Lamps" and the editorial notes thereon in the ELECTRICAL WORLD of May 16 and of April 25. In this connection the theory of occluded gases in the cold filament appeals to me strongly for the following reasons:

In Mr. Taylor's article, Fig. 2, page 1046, the period of time between A, when the current is first turned on, and the first visible record of the light, is only about one-fifth as long as the time between D, the second time the current is turned on, the first subsequent visible record of the light. Assuming the temperature to be the same at D as at A, the increment of temperature is about five times as great the first time the lamp is lighted. Assuming, however, the filament to be still hot at D, which assumption is, of course, necessary to the theory of a lag of resistivity behind the temperature, the increment of temperature is about 10 or 12 times as great the first time the lamp is lighted as it is after the lamp has been turned off for two-thirds of a second. This would mean that the initial current at A was not less than, and possibly much more than, 10 or 12 times the initial current at D, and as the voltage is the same in both cases, the resistance was at least 10 or 12 times as great at D as at A, a difference which, I believe, is greater than is found to be the case. Also, assuming a time lag of resistivity, I fail to see why there was not an appreciable, though probably less pronounced, overshooting at D as well as at A. It would be very interesting and somewhat enlightening in this connection to know just how long the current has to be turned off to cause this phenomenon of overshooting to occur on relighting.

On the other hand, it would seem possible that the increased incandescence on first lighting is caused by a chemical reaction between the filament and traces of occluded gases, as, for instance, the filament absorbing and occluding, much after the

manner of platinum, minute quantities of oxygen; part of this oxygen when the filament is moderately heated combining with traces of carbon or some other impurity in the filament, or even with the tungsten itself, and producing this temporary incandescence from the mere heat of the chemical reaction. This is merely a conjecture, as the existence and the nature of a chemical reaction in this case could be determined only by elaborate experiment.

In any event, it would be interesting and possibly of some practical usefulness to know the exact nature of this phenomenon, as it may have a decided influence upon the life of the tungsten lamp when used with a sign flasher or under similar conditions. I do not know whether or not series of life tests of tungsten lamps under these conditions have been made, but the results of such a series of tests would be of interest.

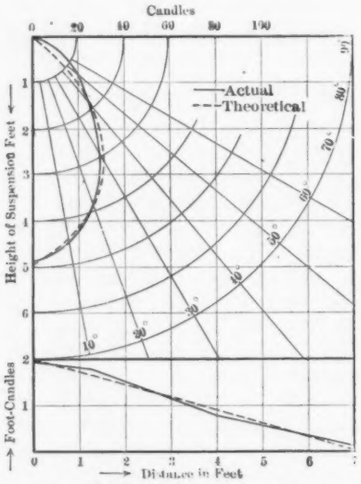
Milwaukee, Wis. James J. Doyle.

Uniform Illumination of Horizontal Planes.

To the Editors of Electrical World:

Sirs:—In your issue for May 23, Mr. Ernst W. Weinbeer calls attention to certain features of two of my articles which appeared in previous issues of the Electrical World, wherein my assumption did not agree with existing conditions. In the articles referred to it was distinctly stated that the polar candle-power curve selected was given a certain form for theoretical reasons. However, the discrepancy between the assumed form and the forms that can be obtained is not of sufficient importance to detract from the value of my articles.

Moreover, I do not agree with Mr. Weinbeer that the polar candle-power curve selected cannot be realized in practice. I believe it is possible to give to the candle-power curve of a



POLAR CANDLE-POWER CURVE.

lamp any shape desired, and it is not difficult to concentrate the whole light flux from a lamp on an area corresponding to a certain polar-angle, just as the total flux is frequently utilized in only one hemisphere.

It was shown in one of the articles mentioned above that by the use of a prismatic reflector there can be obtained a polar

Comparison Between Theoretical and Actual Candle-power and Illumination Curves.

Angle Degrees.	Light in candles. Theoretical.	Practical.	Illumination in foot-candles. Theoretical.	Practical.
—	98	97	.2	1.98
10	87	92	1.72	1.8
20	77	77	1.3	1.3
30	62	55	.83	.74
40	37	37	.34	.34
50	—	25	—	.13
60	—	15	—	—
70	—	—	—	—
80	—	—	—	—
90	—	—	—	—

Theoretical—Illumination curve a straight line. $K = 1$. $I_0 = 2.07$. $D = H = 7$.

Practical—Illumination curve of a No. 700 National X-Ray Reflector.

candle-power curve approximately equal to the one assumed by me. I may now add that by the use of mirror reflectors one can completely fulfill all demands. As indicated by the accompanying table and illustration, excellent results can be obtained with a so-called "X-Ray" reflector.

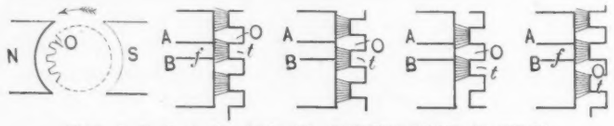
The writer believes that the use of the theoretical polar candle-power curve assumed in my article is fully justified, because by the use of such curves it is possible to place the calculations connected with illuminating engineering on a thoroughly scientific, as well as practical, basis.

New York, N. Y. Alfred A. Wohlauer.

Loop vs. Cutting Lines of Force.

To the Editors of Electrical World:

Sirs:—With reference to Mr. Carl Hering's statement as to the "Loop vs. the Cutting Lines of Force Laws" in an article in your issue of March 14, and also a paper printed in the March number of the American Institute of Electrical Engineers, I should like to ask an explanation of a fact which seemingly belongs neither to the former nor the latter law of induction. Let us suppose a conductor embedded in a slot of a toothed armature of an ordinary direct-current machine. Now, for



FIGS. 1, 2, 3, 4, 5.—LOOP VS. CUTTING LINES OF FORCE.

the sake of simplicity, let us assume that all flux pass through the teeth but nothing through the slots, also that the conductor has no connections at either ends—that is, it is simply a straight wire, so that no "looping" law applies in the case. Now, revolve the armature in the direction indicated by the arrow head. Consider a small portion of the field magnet, such as *A B;* a glance through Figs. 2, 3, 4 and 5 will convince us that the flux density at *A B* varies from a maximum to zero, and when the conductor passes from the point shown in Fig. 2 to that of Fig. 5, the flux "*f*" has not remained fixed, but has passed along with the tooth "*t.*" In a word, the conductor never "cuts" the flux nor does the flux cut the conductor. According to Faraday's law, the conductor must cut flux to generate any e.m.f. Now, it is a plain fact that the conductor does generate an e.m.f. in passing through from Fig. 2 to Fig. 4, although it never cuts any flux. An interpretation may be made to the effect that although the conductor does not actually cut the flux, the effect will be the same as if it did, because in passing from Fig. 1 to Fig. 5, the conductor must cross the flux "*f,*" as is clear from the figures. But the fact is that the conductor never crosses the flux "*f,*" which disappeared before the conductor came to the portion *A B* and reappeared after it went through it. If the conductor were connected with another one under different polarity, as is done in any actual case, the generation of e.m.f. may easily be explained by the "Looping Theory" of Maxwell.

Ithaca, N. Y. S. Sano.

Grounding the Secondary.

To the Editors of Electrical World:

Sirs:—Under date of March 14 you publish some remarks in regard to the attitude of the Underwriters toward the rule proposed by various electrical interests for grounding secondaries, in which you rather reflected on the Underwriters for not having taken prompt action when this rule was suggested to them. We replied to this article, our letter appearing in the issue of March 21.

We notice in the issue of May 23 that you have now become fully informed of the details of the proposed substitute for Rule 13 A, as presented at the Chicago meeting of the National Electric Light Association, and we are pleased to note that you are no more ready to accept this proposed substitute off-hand than were the Underwriters, and that you also feel that you would like to be advised why certain provisions were introduced in the rule in just the form they appear.

This editorial of yours in the present issue of the WORLD is naturally pleasing to us, because it fully justifies—so far as your opinion is concerned—the action of our sub-committee in recommending that the proposed substitute be referred back to them for further conference and consideration.

We were fully aware at the time this recommendation was made that the electrical interests were not a unit in regard to the 150-volt limit, and we were also confronted with what seemed to us a very inconsistent position for the Underwriters to take, unless there was some good and sufficient reason given, that we should compel the grounding where the voltage was not over 150, and go to the other extreme and forbid it when it was over 150.

It seemed to us, that in a matter affecting life, it might be "better to prohibit entirely such classes of installations than withhold protection from those endangered by them."

BOSTON, MASS. C. M. GODDARD.

Series Transformers.

To the Editors of Electrical World:

SIRS:—The article by Mr. Harrar in your issue of May 16 contains some valuable information, but is rather misleading in two points. The diagram (Fig. 5) giving the wattmeter error in terms of the power factor of the secondary circuit has different lines for different phase angles, and it might be inferred that each one of these lines gave the change in error with power factor for a particular transformer. This is not the case, since the angle varies in each transformer with the power factor, and for some low value of the power factor becomes zero. For this value there is no error if the exact ratio be known and used. It is thus evident that the angle used is not the angle at unity power factor, but the actual angle at the given power factor, and this is a variable for any transformer.

I assume that the curves have been computed without respect to the change in ratio, since this cannot be included in the computation unless other constants of the transformer are specified.

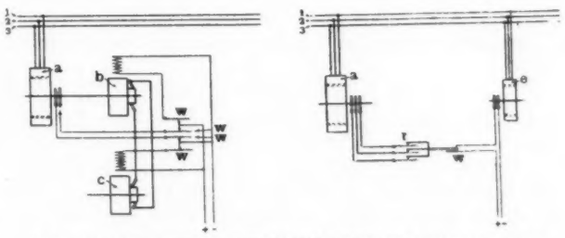
The second point occurs in the specific example computed. In explaining the increase of ratio with decrease of load, it is stated ". . . as the iron loss varies as some power of the induction greater than unity the per cent decrease in watts loss is less than the per cent decrease in induction or in load." The fact is that the decrease in *watts* is *greater*, but as the voltage drops in proportion to induction, the energy component of current decreases at a slower rate than the load; and it is this energy component of current which affects the ratio at high power factors.

WASHINGTON, D. C. M. G. LLOYD.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Generators, Motors and Transformers.

Compensation of Pressure Variations in Alternating-Current Networks.—A. HEYLAND.—Variations in pressure in alternating-current networks are often produced by variations of load on motors, especially by alternations in the wattless components of the currents. The present article describes several arrangements which not only compensate both this drop, but may produce excitation of certain motors connected to the network by variations in the main current, thus giving an effect analogous to "compounding" in direct-current systems. The principle is



FIGS. 1 AND 2.—COMPENSATING PRESSURE VARIATIONS.

explained in Fig. 1, where 1, 2 and 3 are alternating-current mains, *a* a motor connected to them, *r* its starter or regulating rheostat and *e* an alternating-current machine coupled to the network, excited by continuous current (+ and —), whose excitation may be regulated by means of the resistor *w*. If the motor *a* has a large starting torque, the current at starting will be maximum, and will diminish until the short-circuit position of the rheostat *r* is reached. Further, the voltage drop in the network, caused by this motor, will be a maximum at starting, and will decrease for normal working. It is, therefore, very easy to make the resistors *r* and *w* interdependent, say, by connecting them mechanically, so that the excitation of *e* is varied approximately in the same degree, but in an inverse sense, as the voltage drop produced by *a*. The voltage drop of the network may thus be compensated, or even raised, when *a* is overloaded. Instead of connecting the resistor mechanically, *e* may be regulated in any other appropriate manner which is dependent on the working of *a*. Another application of this principle is shown in Fig. 2. A motor receives energy from a motor-generator, the object of which is to obtain economy in starting and regulation. The alternating-current motor is *a*, and *b* is the direct-current generator of the set, while *c* is the motor, in this case of the continuous type, connected to it. The regulating resistors of the different machines are represented by *w, w, w, w*, and it is supposed that these are connected up in an appropriate manner in order that the excitation of the alternating-current motor *a* may be regulated automatically, according to the operation of the motor-generator and the state of the load, in such a way that the line voltage may be conveniently regulated. Quite a number of other arrangements involving the same principle are also described and illustrated.—Lond. *Elec.*, April 24.

Direct-Current Generators.—E. KORRODI.—An illustrated article on direct-current generators for lighting, industrial and tramway service. Combined lighting and traction plants have a smaller total generator equipment than separate plants, as the combined maximum demand is much less than the sum of the two maxima, and fewer spare sets are required with only one type of generator. This advantage is, however, somewhat reduced by an increase in the size of the generators, which, in the case of ordinary direct-current machines at from 440 to 480 volts and from 500 to 550 volts, is about 30 per cent, and is partly due to the more severe commutation conditions at the lower voltage. As the size of interpole machines depends upon the product of maximum current and maximum voltage, their increase in rating is only 15 per cent. Thus, it is possible to build interpole machines of sufficient size to carry the maximum overload, under any condition of voltage, more economically than those of the ordinary non-interpole type, and with at least as good performance.—Lond. *Elec.*, May 1.

Lamps and Lighting.

New Incandescent Lamps.—A continuation of the long serial on recent progress in incandescent lamp invention. The firm of J. Lux, in Vienna, has patented a method of making tungsten lamps, based on the property of amidoderivatives of diphenyl to form compounds with tungsten. The same firm uses the following method for finding any weak points (of thinner diameter) in the filament produced: The long filament wire is electrically heated for about a second in air to a predetermined temperature. Any weak points which have a reduced cross-section light up and are at the same time oxidized so that when cooled they show the color of the oxide and can be cut out. The Wolframlampen A. G. makes tungsten filaments by starting

with tungsten compounds like tungsten oxide, etc. The compound is finely powdered and mixed with pure water so as to form a plastic mass. It is then strongly compressed by hydraulic pressure and formed into rod or filament form. After the filaments have been dried they are embedded in a refractory material, like magnesia, etc., and placed in a closed graphite crucible, which is heated to from 1500° to 1800° C., dry hydrogen gas being simultaneously passed through the crucible during the whole period of heating. After from 12 to 24 hours the tungsten-compound filaments are reduced to pure metallic tungsten filaments free from carbon. It is also possible to start with powdered tungsten, but when it has been made up with water into a plastic mass they can be pressed into filament form only after having been mixed with finely-powdered sulphur. Less sulphur is used than is necessary for converting the tungsten into the sulphide. These filaments are treated in the way as described above in a hydrogen atmosphere with simultaneous heating, whereby the tungsten is converted into sulphide and at once reduced again to pure metallic tungsten. Another process of the same company relates to the deposition of a layer of tungsten on carbon filaments. This is done under reduced pressure (preferably at 200 mm of mercury) in an atmosphere of a vapor of a tungsten compound with a reducing gas like hydrogen, while the carbon filament is electrically heated. In order to get filaments of the same composition it is preferable to carry out this process by connecting a number of the filaments in series. If one of them has a smaller diameter than the others then it will be heated to a higher temperature and will receive a thicker deposit so that the final filaments are of equal cross-section. Before this process has been completed, each filament should receive a very small preliminary cover of tungsten.—*Zeit. f. Beleucht.*, April 10.

Metallic-Filament Lamps.—An illustrated review of various types of new metallic-filament lamps on the market in England. Besides the well-known osram and tantalum lamps and others, which have already been mentioned in the Digest, the following are noticed: The "Aegma" lamp (nature of the filament not stated) is built for any e.m.f. between 1 and 140 volts, the specific power consumption being between 1 and 1½ watt per hefner candle, and the life from 800 to 1000 hours. Another company builds "series units" of 6 cp or more and joins a number of such units (up to 10) by means of special fittings in a single lamp holder. Whenever the filament in one unit breaks, a resistor of equivalent resistance is automatically substituted. This substitutional resistor and the automatic device are provided within the series unit itself. The series units cost 25 cents, or 33 cents with the safety fuse complete. Where several are used to form a cluster, the failure of one unit means that the original candle-power (50 or 100) can be maintained at a cost of a single unit of 6 cp or so only. The "simplex" is a tungsten lamp consuming 1 watt per hefner candle and having a life of 1000 hours. It is made for voltages from 50 (25 cp) to 250 (50 cp). The "Orieco" lamp is claimed to have a filament different from that of other metallic-filament lamps, none of the component parts used by other manufacturers entering into its production. In another lamp use is made of a platinum-rhodium filament on which there is deposited a layer of oxides of rare earths, which become incandescent through the heat developed in the metallic filament; such lamps are made for 25 volts, with candle-powers of 8, 16 or 20.—Lond. *Electrician*, May 1.

Generation and Transmission.

Hoisting for Canals.—A. Hundt.—The first part of a detailed fully-illustrated description of an electric hoisting installation of the Dortmund-Ems Canal, in Germany, for overcoming a difference in level of from 14 to 16 m. The canal boat to be raised floats within a water tank supported by a number of floating bodies; the floating force, which drives the latter upward, is so chosen in relation to the total weight that the whole system is approximately in equilibrium at any height. A comparatively small amount of energy is, therefore, sufficient to raise the tank. A 150-hp direct-current motor is used. The tank with the boat is raised with a speed of 0.111 m per second. The current is 800 amp at starting, but drops to 100 amp after five seconds and increases again to about 350 amp on account of variation of the flotation force.—*Elek. Zeit.*, April 16.

Induction Motors.—G. Stevenson.—A paper read before the Glasgow section of the (Brit.) Inst. Elec. Eng., advocating the use of squirrel-cage induction motors for electric driving in preference to slip-ring motors, even for motors up to 100 hp. The author described the application of friction clutches to electric driving with squirrel-cage motors, and finally criticised the regulations of local authorities and supply companies with regard to the installation of squirrel-cage motors.—Lond. *Elec. Eng'ing*, April 23.—In the discussion which followed most of the speakers disagreed with the author's view that squirrel-cage motors, in conjunction with friction clutches, are superior to slip-ring motors.—Lond. *Elec. Eng'ing*, April 30.

Rolling Mills.—H. Crowe.—An illustrated paper read before the Cleveland Inst. of Engineers on a form of the Ilgner system for driving reversing rolling mills, with a series of records of current consumption in actual cases. The general advantages of electric-motor driving over steam engine are also pointed out.—Lond. *Elec. Eng'ing*, April 23.

Paraffine Engine.—An illustrated description of the Allen vertical four-cycle paraffine engine.—Lond. *Elec.*, May 1.

Traction.

Single-Phase Locomotive.—W. Wechmann.—An illustrated description of the first single-phase locomotive used by the Prussian State Railways on a trial road near Oranienburg. The locomotive has two four-axle trucks. Three axles are equipped with a single-phase motor of the Winter-Eichberg type rated at 350 hp at 450 r.p.m. for one hour, or at 250 hp at a speed of 500 r.p.m. for continuous operation. The ratio of gearing is 1 to 4.21. The maximum speed of the locomotive is 50 km per hour. Drawings of the locomotive are given.—*Elek. Zeit.*, April 23.

Emergency Brake.—An illustrated description of an emergency brake of exceedingly simple construction devised by P. J. Pringle. The special feature is that it operates on the rail groove instead of the rail tread. There is provided a steel shoe or skid, shaped to enter the groove of the rail, which can be dropped in front of the car wheel, causing the wheel flange to mount the trailing end of the skid so as to bring upon it the weight normally carried by the wheel. The brake is only intended for emergency stops, and is somewhat violent in its action.—Lond. *Elec. Eng'ing*, April 30, and Lond. *Electrician*, May 1.

Electric Traction in Austria.—von Ferstel.—An account of the work done by the Bureau of the Austrian State Railways for studying and preparing for the introduction of electric traction. The chief incentive is the rapid rise of the price of coal. The Austrian Government Department which operates the railways had to pay a 64 per cent higher price for coal during the last two years. The bureau is making a general investigation of all water power westward of Salzburg which could be developed for electric-railway operation, and has already made a survey of 12 water-powers, with an aggregate rating of 40,000 hp.—*Elek. Zeit.*, April 16.

Water Power for Electric Traction.—W. Conrad.—A paper read before the Electrical Society of Vienna discussing the chief principles to be considered in the choice and development of water powers in the Alps for the use of electric traction. The author deals at some length with the necessity of artificial storage of water.—*Elek. und Masch.*, April 12 and 19.

Installations, Systems and Appliances.

Leoben.—An illustrated description of the electric station of Leoben, in Austria, utilizing a water power. There are two 500-hp Francis turbines driving two 5200-volt, three-phase generators.—*Elek. u. Masch.*, April 12.

Lowell.—An illustrated article on electric-power supply in the city of Lowell, with its textile industry. The equipment of the new power house is described, the principal feature being the use of turbine generators.—*Stone & Webster Pub. Serv. Jour.*, May.

Lightning Protection.—J. F. VAUGHAN.—A review of the causes and effects of lightning disturbances in electric circuits and their remedies. The different protecting devices are briefly described and notes are given on their installation, care and inspection, and a method of keeping records.—*Stone & Webster Pub. Serv. Jour.*, May.

Regulations.—Proposed police regulations concerning erection, operation and supervision of electric installations.—*Elek. Zeit.*, April 16.

Wires, Wiring and Conduits.

Heating of Cables with Intermittent Load.—R. APT.—The author shows that Oelschlaeger's formulas for temperature change of resistors through which currents pass intermittently may also be used for the temperature change of cables and insulated conductors at intermittent load. The formula for heating is $t = T\,ln\,(\tau_m \div (\tau_m - \tau)$ and that for cooling is $t = T\,ln\,(\tau_m \div \tau)$, where t is the time in minutes, ln means natural logarithm, τ is the increase of temperature and τ_m is the maximum temperature (which the cable or conductor, when being heated, will ultimately reach). T is a constant which is proportional to the mass and the specific heat, and inversely proportional to the surface and the heat loss per unit of surface; it is independent of the temperature, the current used, the period of intermittent operation, etc. T is called by the author the "time-constant" and is measured in minutes, and gives the time in which the temperature rise becomes 0.633 times the maximum temperature increase. The curves for τ as function of t are exponential curves. That the above formulas can be applied for cables is shown by plotting the heating curves for one and the same cable at different (constant) currents, each curve relating to a certain current; then it is found that all the curves have the same time-constant. On the basis of experimental measurements of the heating and cooling of cables, buried in earth, the time-constant has been determined by the author, the results being given in Fig. 3, in which curve *I* relates to single-conductor cables, II to three-conductor cables, both for 700 volts. The ordinates give the time constant in minutes, the abscissas the copper cross-section of a single conductor of the cable in square millimeters. Thus, a 700-volt, 150-sq. mm single-conductor cable has a time-constant of 28 minutes; a 700-volt, 3 × 240-sq. mm three-conductor cable one of 57 minutes.

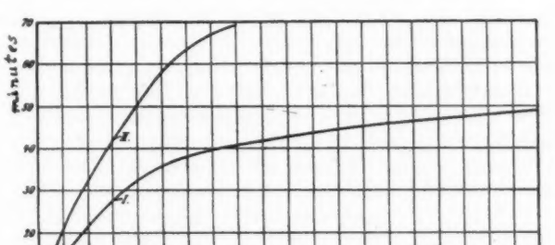


FIG. 3.—HEATING OF CABLES.

Other things being equal, the time-constant increases with the diameter. An intermittent load, as distinguished from a constant load, is characterized by the ratio p of the maximum current at intermittent operation to the maximum current at constant load and is called the overload coefficient. If c is the maximum permissible current at constant load, then $p\,c$ is the maximum permissible current at intermittent load. If the time of a full period is P and that portion of the time of a full period during which current is turned on is called a, then the overload coefficient p is found by means of the equation:

$$\frac{P}{a} = 1 - \frac{T}{a}\,ln\left(p^2 - e^{\frac{a}{T}}(p^2-1)\right)$$

$\frac{a}{T}$ meaning the power;

The overload coefficient p is, therefore, a function of $\frac{a}{T}$ and $\frac{a}{P}$ the first ratio is characteristic of the cooling conditions of the cable (on account of the time-constant T), while the second ratio is characteristic of the intermittent load. If p is calculated from the above formula and the results are plotted diagrammatically, Fig. 4 is obtained. If, for instance, the time of a full period of intermittent operation is $P = 5$ minutes, that part of the time during which the cable carries current is $a = 1$ minute, then $a \div P = 0.2$. If further the time-constant of the cable, as found from Fig. 3, is $T = 10$ minutes, then $a \div T = 0.1$ and we find, from Fig. 4, the overload coefficient $p = 2$. For the

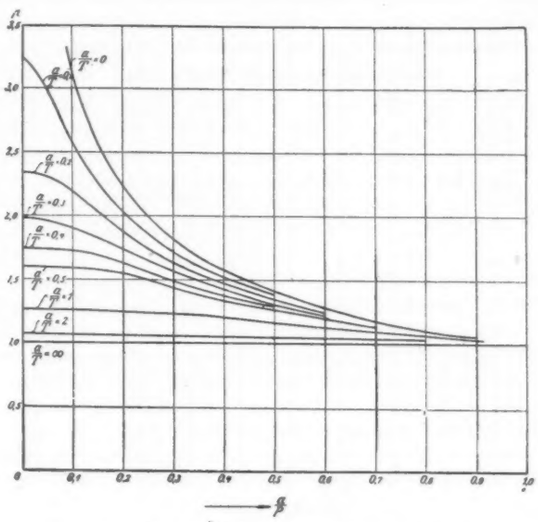


FIG. 4.—HEATING OF CABLES.

operation of cranes the author considers the following two characteristic cases: First, $a = 1$ minute, $P = 2$, $a \div P = 0.5$; second, $a = 1$, $P = 5$, $a \div P = 0.2$. Curve I, of Fig. 5, gives p for the first case and curve II gives p for the second case as function for the time-constant, T in seconds. Approximate calculations of the maximum permissible current at intermittent load are usually based on the mean square of the current over the whole period P; in this case, one obtains the overload coefficient p independent of the time-constant; this approximate

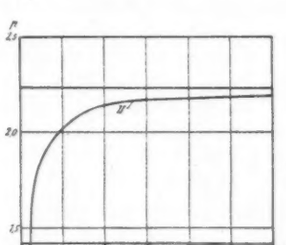


FIG. 5.—HEATING OF CABLES.

value of p is represented in Fig. 5 by the two thick horizontal lines, being asymptotes to the two p curves. This approximate calculation is, therefore, permissible only for large values of $a \div P$ and for large values of the time-constant T. For the two cases of crane operation, defined above, Fig. 5 gives directly the coefficient p by which to multiply the permissible maximum current for constant load in order to ascertain the desired permissible maximum current for intermittent load.—*Elek. Zeit.*, April 18.

Bituminous Conduits.—An illustrated article on fiber conduit, which is claimed to maintain its mechanical strength much below the melting point of bitumen. The foundation consists of wood fiber treated in such a manner, and built up under such pressure, as to form a homogeneous wooden tube, which, after slow and careful drying, produces a conduit of considerable

mechanical strength. It is then thoroughly impregnated with the bituminous compound, which, owing to the absorbent nature of the fiber, soaks into the entire structure and so closes up the pores as to make the conduit absolutely watertight.—Lond. *Elec.*, April 24.

Underground Cables.—D. W. Roper.—An illustrated paper describing some unusual burn-outs of underground cables with a full account of the discussion which followed.—*Jour. Western Soc. Eng'rs*, April.

Wiring Materials.—The set of rules which have been issued by the Transvaal Minister of Mines for overhead electric transmission lines in the Transvaal.—Lond. *Elec.*, April 10.

Electrophysics and Magnetism.

Discharge in Monatomic Gases.—F. Soddy and T. D. Mackenzie.—A Royal Society paper giving an account of an experimental investigation of electrical discharges in monatomic gases like helium, argon and neon. The monatomic gases in general appear to be what has been termed electrically inert, and if the effectiveness of a molecule in permitting or resisting the passage of a discharge is to be associated with the number of relatively free electrons it contains, the monatomic gases appear, from their electrical as well as from their chemical inertness, to be relatively deficient in easily displaceable electrons. But this point of view carries with it the corollary that their chemical inertness is relative rather than absolute, since even in the purest state the monatomic gases are undoubtedly capable of conducting and becoming ionized.—Lond. *Elec.*, April 24.

Colloids.—A. Mayer and E. Salles.—An account of experiments made on the movement of colloids under the influence of an electric field. As a typical colloid the authors used the trisulphide of arsenic, AsS_3. It is usually supposed that the particles of colloid solution are uniform in size, and have all the same electrical charge, if any. This would imply a uniform rate of transportation. Such a uniform rate is, however, not observed. In fact, the repulsion of one electrode is greater than the attraction of the other, so that if a small column of the colloid solution is enclosed in a long column of liquid, the front end of the repelled column advances less rapidly than the rear portion. The authors make it very probable that the whole motion is not due to any charge of the colloid particles themselves, but that these are dragged along by the motion of ordinary electrolytic ions evolved from them. There is no motion at all unless the e.m.f. suffices to produce traces of electrolysis. The speed increases more rapidly than the e.m.f. The addition of an electrolyte, like KCl, increases all the speeds. Moreover, the preceding colloid may be observed to thicken, while the following colloid thins out. The electrolytic view is corroborated by observations with the ultramicroscope.—*Comptes Rendus*, April 13; Lond. *Elec. Eng'ing*, April 30.

Electrochemistry and Batteries.

Electrolytic Corrosion.—W. W. H. Gee.—A paper read before the Manchester section of the (Brit.) Inst. of Elec. Eng. giving a concise summary of the electrolytic corrosion of iron and steel, lead and aluminum on the basis of the observations of many experimenters, with special reference to electrolysis of underground pipes, structures, etc., by railway return currents. Mention is also made of electric endosmose. The effect is a common cause of faults in buried conductors, which are usually found at the negative main. On the negative side there is a constant strain on the insulation tending to drive water through the insulation to the copper. When the water gets in, electrolysis of the alkaline salts that are in solution takes place, and alkalies or alkaline metals are produced. The free metals in contact with water liberate hydrogen which, when mixed with air, forms an explosive mixture that may have caused some of the mysterious detonations that have taken place in mains. The endosmose trouble will be aggravated at high voltages and may prove an obstacle in high-pressure direct-current systems. An account of the discussion which followed is also given.—Lond. *Elec. Eng'ing*, April 9; A complete reprint of the paper, with discussion, in Lond. *Elec.*, April 24, May 1.

Electrolysis of Sodium Chloride.—J. B. C. Kershaw.—A review of the electrolytic alkali and bleach industry in 1907 of the whole world. There were 36 plants working, with a total available power of 52,000 kw. Some notes are given on the Townsend cell and the McDonald cell used in this country.—Lond. *Elec.*, April 24.

Units, Measurements and Instruments.

Thermal Treatment and Magnetic Properties.—J. G. Gray and A. D. Ross.—It is generally known that the process devised by Ewing and called "de-magnetization by reversals" is not quite the equivalent of de-magnetization by annealing. The fact is, that with most materials the magnetic susceptibility is higher after the annealing process than it is in the same specimen after the process of demagnetizing by reversals. Thus, if a rod of iron be annealed from a high temperature and its I-H curve obtained, and then demagnetized by reversals and again submitted to measurement, the second I-H curve lies below the first curve. The present authors have made an experimental investigation in which they employed thin rods of various ferro-magnetic materials, and made their observations by the magnetometer method. They increased the fields up to 125 C.G.S. units, and used for annealing all temperatures from 900° C. downward. They found in all cases that specimens submitted to thermal treatment are in a sensitive state as regards magnetization compared with the same material submitted to demagnetization by reversals. The effect is produced to a slight degree in some cases by temperatures as low as 100° C., but becomes larger as the maximum temperature approaches 700° C. After this latter temperature is passed there is little alteration in the sensitiveness produced by annealing. The rate of cooling from the higher temperatures, if not very rapid (as, for instance, by quenching), has little influence on the magnitude of the effect. The sensitiveness is permanent; that is, does not diminish with the mere lapse of time, but mechanical agitation reduces the sensitiveness. Of course, magnetic treatment produces great changes in the magnetic character of the annealed material. For instance, if the I-H curve for a newly-annealed piece be drawn as the field is increased to, say, 10 units, diminished to -10 units, increased again to $+10$ units, and so on cyclicly, the ascending loops fall lower and lower and the final I is about 20 per cent lower than the I at field 10. In general, cyclic reversals of field between definite limits bring the magnetic susceptibility, etc., to lower values for fields lying between those limits; but so long as the field is not changed in sign the sensitive state persists almost unimpaired. The effect of the magnetic treatment is always shown most prominently at that field value where the permeability is greatest, and tends to zero as saturation is approached. The authors found that the most striking effects are given with hard steel, though similar properties are found in cast-iron and cobalt. The effect is almost absent in soft iron.—*Proc. Royal Soc. of Edinburgh*, April; Lond. *Elec. Eng'ing*, April 23.

Electric Hygroscope.—J. Pionchon.—A description of a novel device for the detection of minute traces of moisture. It is based upon the property of a clean glass surface of attracting moisture in proportion to the moisture of the atmosphere in contact with it. A glass tube, 10 cm long, closed at one end, is silvered inside and out to within 1 cm of the open end. The bottom is then cut off, leaving a fresh cut, which separates the two silvered surfaces. This cut is the sensitive portion of the instrument. The cut is, however, not left in the rough state, nor fused, but is polished with fine emery. Wires are connected with the inner and outer coatings, and are inserted in a circuit containing a galvanometer and a 100-volt battery. The deflection of the galvanometer is then found to vary greatly with the moisture of the atmosphere. The mere approach of a moist body affects it. The hand held at a distance of 1 cm produces various effects in accordance with the part which happens to be near the sensitive surface. The back of the hand produces a deflection of 3 or 4 cm. The point of a finger throws the spot off the scale. The amount of moisture liberated by the heat of the hand from a paper tube is easily detected. A valuable property of the new hygroscope is the constance of the zero, which is rapidly recovered.—*Comptes Rendus*, April 13; Lond. *Elec. Eng'ing*, April 30.

Measuring Small Alternating Currents.—An article describing thermal instruments for the measurement of small alternating currents of high frequency. The Duddell thermal ammeter, which is based on the measurement of thermo e.m.fs., is described and illustrated.—Lond. *Elec.*, May 1.

Telegraphy, Telephony and Signals.

Longitude by Wireless Telegraphy.—B. DE LA GRYE.—Details of his proposals for an international hour signal by wireless telegraphy. Chronometers and occultations are to be supplemented by a daily hour marked by a wireless wave capable of being received all round the world. The Eiffel Tower station has a range of 1300 miles, and would cover the busiest portions of the Atlantic. For a world-wave, something larger would be necessary. The Peak of Teneriffe has been proposed. It is 3710 m high, with an average gradient of 13½ deg. The possibility of such a service has been acknowledged by Becquerel, chairman of the Wireless Commission, instituted by the French government, and by Admiral Gascard, who is in charge of the wireless service to Morocco. The latter does not, however, think that Teneriffe is necessary. A sea strand, 6 km long, such as is available at Guetn'dar, Senegambia, in the region of the trade winds, would be more convenient and quite effective. A beginning might be made with a service from the Eiffel Tower. The world-signal would have to be dispatched at midnight, in order to get the maximum range of transmission along the dark half of the globe. The proposals have been referred to the Astronomical, Geographical and Physical sections of the Academy.—*Comptes Rendus,* March 30; Lond. *Elec. Eng'ing,* April 16. In connection with this subject, E. Guyon quotes a resolution adopted by the Bureau des Longitudes on Jan. 22. The resolution, after referring to the gratifying success of the Morocco naval service and the hour-signals from Camperdown (Halifax), draws special attention to the usefulness of the Paris-Brest hour-service inaugurated by C. Tissot with the aid of the Eiffel Tower installation. The resolution further details the steps which would be necessary for the establishment of an international service for the determination of longitude at sea. A determination of longitude requires an observation of an astronomical phenomenon involving right ascension, such as the southing of the sun or a star, and a simultaneous reading of time. The difference in time between the chronometer reading and the time at which the same astronomical event takes place under the standard meridian is the longitude expressed in time. A wireless service of time would eliminate all errors involved in the rating of chronometers. Such a service can only be efficiently organized by an international committee of electricians and seamen. M. Guyon had been instructed by the Bureau des Longitudes to take the first steps toward the organization of such a committee.—*Comptes Rendus,* April 13; Lond. *Elec. Eng'ing,* April 30.

Wireless Telegraphy.—Last year's report on Marconi's wireless Telegraph Company with some notes on transatlantic transmission. The report does not look with favor upon the international radiotelegraphic convention, which is regarded as a result of foreign intervention.—Lond. *Elec.*, April 24.

Miscellaneous.

Machines for Winding Coils.—O. HARTMANN.—An illustrated description of various machines for winding magnet coils.—*La Lumière Elec.*, April 18.

Metric System.—C. E. GUILLEAUME.—The conclusion of his article on recent progress in the application of the metric system. The author gives a review of legislation in different countries and describes various instances in which the use of the metric system has made progress in different industries.—*L'Industrie Elec.*, May 10.

Laboratory.—L. FABRE.—A profusely illustrated description of the electrical laboratory of the Institute of Technology, at Karlsrühe.—*La Lumière Elec.*, April 25.

Arrangement of Manufacturing Plants.—G. M. BRILL.—A long and fully illustrated paper discussing the best location, arrangement and construction of manufacturing plants.—*Jour.* Western Soc. Eng'rs, April.

BOOK REVIEW.

THE STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS. Written and compiled by a staff of specialists. Second edition, corrected. New York: McGraw Publishing Company. 1250 pages, illustrated. Price, $4.

In this new edition of the Standard Handbook the typographical and other errors that naturally will appear in the original issue of a book of its class have been corrected. By the use of a different paper, the weight of the book has been decreased and its thickness reduced by a quarter inch. A notable improvement of the same order is the adoption for this edition of a thumb index to sections. While, as a rule, a thumb index is of little value in a handbook, in this specific case it is of particular importance for the reason that index references are to sections and paragraphs, not to page numbers.

Double-Flow Steam Turbines.

There has recently been installed in the Brunot Island generating station of the Pittsburg Railways Company a horizontal steam turbine of the balanced-thrust type, which possesses many interesting constructional features. The turbine is built on the double-floor principle, such as employed in hydraulic turbines. This principle has been applied in low-pressure turbines designed to utilize exhaust steam from reciprocating engines, as illustrated in Fig. 1. The high-pressure machine resembles the low-pressure turbine, with the addition of a high-pressure

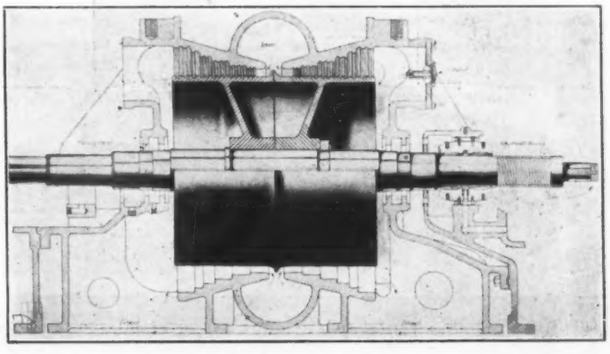


FIG. 1.—SECTIONAL VIEW OF ORIGINAL LOW-PRESSURE DOUBLE-FLOW DESIGN.

impulse element mounted at the center of the rotor, as shown in Fig. 2. The impulse element acts like the high-pressure cylinder in a double expansion or triple-expansion reciprocating engine.

The low-pressure section of the turbine being in two parts, receiving steam from opposite directions, there is no resultant axial thrust in this section. A balance-piston of modest diameter overcomes the thrust of the high-pressure section. It is claimed that, as a result of the increased speed permitted by the double-floor arrangement, there is a large reduction in the weight of the individual parts to be handled in assembling. Moreover, the impulse element is well adapted to high pressure and supertemperature.

In the construction of the blades use is made of a special compound metal known as "Minnot," which consists of a steel core covered with a thin copper sheathing chemically welded to the steel in such manner that the blades may be drawn cold from the original ingot into the required finished section without affecting the bond between the copper and the steel. Experiments have shown that the copper offers a high resistance to chemical corrosion, resulting from bad feed water carried over in the steam during priming, while the integrity and strength of the steel core is not lost.

Fig. 3 indicates the method by which the blades are reinforced. Comma-shaped holes are punched in the blades at any desired point of reinforcement. The blades are then strung

onto a comma-shaped lashing wire through these holes. After the blades have been caulked into the rotor or stator, the tail of the comma-shaped lashing wire is sheered over by a tool,

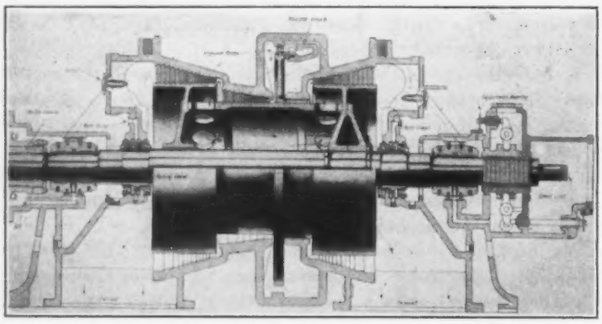


FIG. 2.—SECTIONAL VIEW OF NEW HIGH-PRESSURE DOUBLE-FLOW TURBINE.

as shown at the center in Fig. 3. This process wedges the tail of the lashing wire into the contracting space between the face and back of the adjacent blades, acting as a strut while the lashing wire itself acts as a tie, thus securely interlocking the

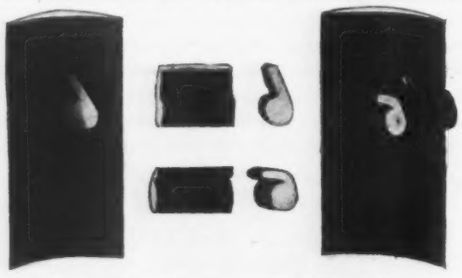


FIG. 3.—METHOD OF REINFORCING BLADES.

blades and preventing vibration. Moreover, the short section remaining in the blade after being sheared off acts as a key to prevent a possible broken blade from injuring adjacent rows.

The system of governing used in the double-flow turbine is essentially the same as that employed in the single-flow type, namely, the "puff" system. There being a constant number of admissions per minute with a variable duration of admission according to the load. In case of over-speeding, the main throttle valve is automatically closed by means of a spring-balance plunger located at the end of the main shaft. Normally the pressure of the spring is so adjusted that the plunger is held to its seat; should the turbine speed for any reason, however, exceed a predetermined value, the end of the plunger emerges, trips a relay valve and operates a quick-closing throttle. It is to be noted that this throttle valve is closed by releasing the pressure beneath its piston, so that any accident to the pipe connections of the speed limit device would instantly bring the turbine to rest.

A 3000-kw turbine of the above-described type has been in use in the Brunot Island station for nearly one year, while three 5000-kw turbines of the same type are in course of erection. The electrical ends of the turbine units are revolving-

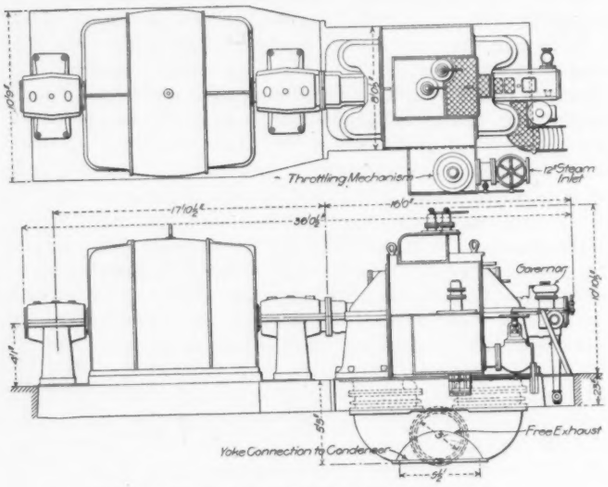


FIG. 4.—DIAGRAMS OF DOUBLE-FLOW TURBINE.

field generators of the special construction used for direct connection to turbines. They are wound for three-phase alternating-current at 11,000 volts and 25 cycles. An interesting feature of their operation at the Brunot Island plant is that they are run in electrical parallel with two-phase, 6600-volt generators driven by reciprocating engines. They are fitted with the usual cooling air ducts, air being taken in from under-floor connections. The generators were built by the Westinghouse Electric & Manufacturing Company, and the turbines by the Westinghouse Machine Company, of Pittsburg, Pa.

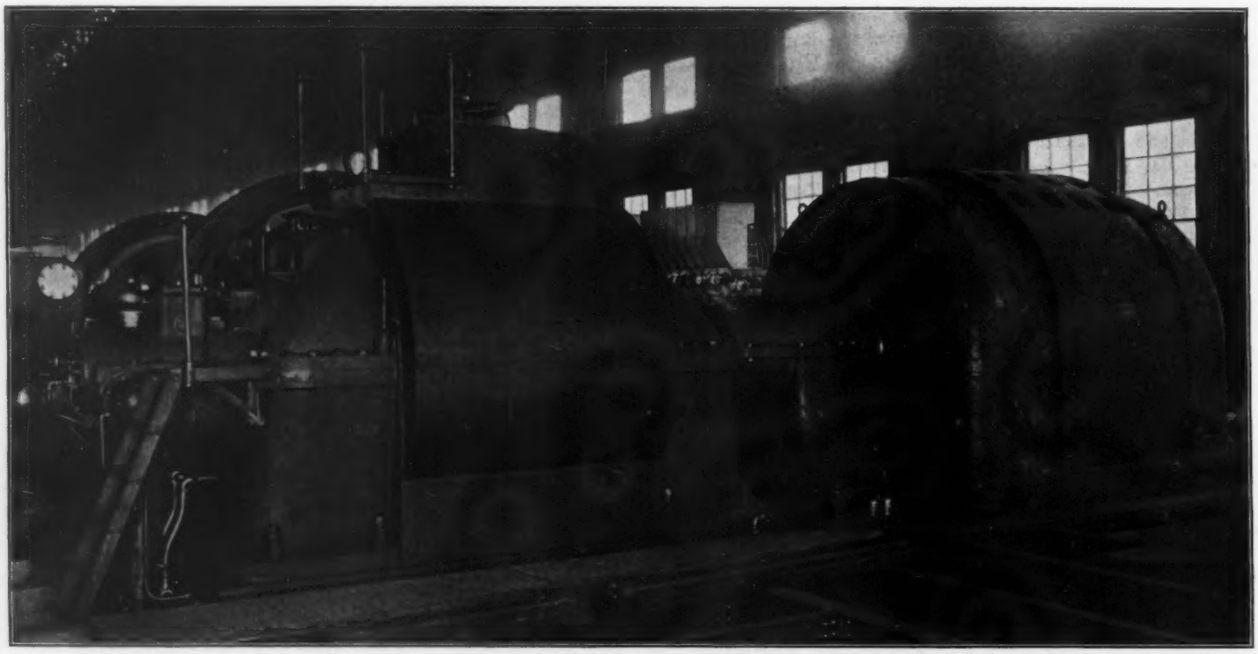


FIG. 5.—GENERAL VIEW OF DOUBLE-FLOW STEAM TURBINE.

Exhibit Notes
Chicago N. E. L. A. Convention.

THE exhibits of supplies and apparatus at the Chicago convention of the National Electric Light Association last week were very attractively arranged in the hall on the ninth floor of the Auditorium Hotel. At 8 o'clock Monday evening President Farrand threw in the main switch controlling the general lighting of the hall. What made this event particularly remarkable was the fact that tungsten lamps were used entirely for the lighting of the hall. The brilliancy of the illumination was generally commented on as admirable, and the whiteness of the light, as compared with that of a few incidental carbon filaments nearby, was generally eulogized by visitors. The plan of lighting has already been described and note has been made elsewhere of the splendid work of the exhibits committee. It may be mentioned that in addition to the exhibits and persons noted below, there were several hundred firms and individuals in attendance not exhibiting or even bringing samples, but contributing by their presence to the extraordinarily representative character of the gathering as a whole.

THE EXCELLO ARC LAMP COMPANY hung nine flaming arcs to "burn up" the front of the Auditorium, and enable the delegates to locate the headquarters building. Messrs. G. W. Armstrong, H. W. Fowzer and W. R. Smith, of the Chicago office, looked after the company's interests.

THE GREGORY ELECTRIC COMPANY held a continuous reception in its booth. The company's exhibit consisted of a number of photographs of its modern and well-equipped shops. A large proportion of the business done by this company is in connection with the handling and repair of second-hand dynamos and motors. The company was ably represented by A. Louis Kuehmsted, president; A. O. Kuehmsted, G. C. Besold, J. D. Zook, J. A. Vincent and E. H. Nagelstock.

THE CROCKER-WHEELER COMPANY exhibited small direct-current and alternating-current motors and lighting transformers. The alternating-current transformers exhibited were of a new type manufactured by this company. Up to a short time ago the company had never made alternating-current induction motors in the smaller sizes, from 25 hp down, but has now found it profitable to do so. The exhibit attracted the attention of a great many visitors who are well acquainted with the efficiency of the Crocker-Wheeler apparatus. Pamphlets describing the 50,000-hp hydro-electric plant of the sanitary district of Chicago, located at Lockport, Ill., were distributed. The representatives of the company included Mr. Rodman Gilder, H. E. Kerber, H. A. Brown, Julian Roe and William F. Sullivan.

PETTINGELL-ANDREWS AND CENTRAL ELECTRIC COMPANY.—At the combined booth of the Pettingell-Andrews Company and the Central Electric Company, a number of interesting specialties were shown. Among these were the O. K. fuse-block cover and a meter-connection block, which are of great interest to central-station men, who recognize the importance of unaccounted-for current. The remote-control switches were shown in several different forms, and weatherproof oil switches and O. K. ground clamps were in evidence. The meter-connection block and D. W. selective type of entrance switches make an interesting combination for service installations in which no exposed wires are left on the customer's premises. The work of testing and replacing meters is simplified by their use. So much stress has of late been placed upon the subject of high-efficiency lamps and reflectors that many central-station men lose sight of the artistic effect that may be obtained in electric illumination through the use of simple brackets and hangers. In order to show what may be accomplished at small expense, the Pettingell-Andrews Company and the Central Electric Company equipped their combined booth with a number of simple brackets of original design which attracted no little amount of attention. These fixtures were samples of the class of work that can be turned out at the company's plant. Messrs. F. S. Price and G. E. Palmer represented the Pettingell-Andrews Company and H. W. Young the Central Electric Company.

H. W. JOHNS-MANVILLE COMPANY.—One of the first things to attract attention at the H. W. Johns-Manville exhibit was the way the booth and sign were illuminated. The new "Linolite" system of lighting was used and its advantages for this kind of illumination clearly indicated. A series of tubular electric lamps, each 1 ft. between centers, with a filament extending from one end to the other, are placed in the focus of a powerful aluminum reflector, the depth of which is 1 in. and the width 1½ in. Linolite in its present form is very largely used for lighting show windows, show cases, general illumination, etc., in which instance the reflector is furnished in any desired length to give a continuous line of light. Several new forms of Linolite lamps were shown with parabolic reflectors for desk and picture lighting, signs, etc. A large line of Victor portable and switchboard instruments, including a portable lamp-testing meter, were also shown and demonstrated. The latter instrument is a convenient one for testing incandescent lamps. It indicates the voltage, current consumed and watts at a glance. It is calibrated for 150 and 300 volts, 0.75, 1.5 and 150 amp. All shunts are self-contained. The two of smaller capacity have universal binding posts. This instrument weighs less than 15 lb. complete. A switchboard and sample board made of ebony asbestos wood were shown, and several new forms of Noark fuse devices, which include service and subway boxes of the latest types. The company's interests were looked after by Messrs. T. G. Younglove, E. B. Hatch, F. G. Frumveller, J. W. Perry and H. M. Frantz.

THE ALLIS-CHALMERS COMPANY exhibit included samples from the stock of the power and electric apparatus manufactured by the company. One of the interesting features of the exhibit was a board which contained samples of all turbine blading of different sizes as used in the 1500-kw steam turbine. The company also showed one of its type K motors for direct-current use, standard type induction motors for alternating-current use, a new type A.L. lighting transformer, and new Allis-Chalmers friction clutches. On the walls of the booth, framed illustrated title pages of 52 power and electrical bulletins were hung. During the sessions of the convention particular attention was called by the company's representatives to the four Allis-Chalmers gas engines and generators being installed at the plant of the Illinois Steel Company, in South Chicago. Each installation consists of a horizontal twin tandem double-acting gas engine turning at a speed of 83 r.p.m., direct-coupled to a 2000-kw, 25-cycle, three-phase, 2200-volt, alternating-current generator. The company claims these are the largest engines in the world operating on blast-furnace gas. The engines are practically duplicates of the electrical units to be installed at Gary, Ind. The Allis-Chalmers Company has had gas-engine driven electrical units of 300 to 1000 kw in operation on both alternating- and direct-current load, but these are the first of the large units to be put in service. The company was represented by President W. H. Whiteside, W. J. Heger, assistant to the president; James Gardner, of the Chicago office; B. A. Berne, A. H. Whiteside, C. A. Tupper, E. T. Adams and Messrs. Frankenfield, Van Zandt, Catlin, Marburg, Smith, Davies, Nicholson, Burdick, Jeffrey, Collins, Hall, Vrabek, Watson, Howe, Keene, Kerr, Peck, Williamson, Bogen and Dennison.

Mr. Alfred T. Webb was on hand for the E. E. Cary Company.

Mr. W. F. Hubley, of the American Transformer Company, was in attendance.

Mr. Frank L. Driver, of the Driver-Harris Wire Company, spent a couple of days at the convention.

The Ansonia Electrical Company, Ansonia, Conn., had President Thomas Wallace in attendance.

Mr. J. H. Mason, of the Simplex Electrical Company, Boston, put in an appearance at this convention and greeted his many friends.

The Okonite Company was represented by Mr. George T. Manson. He was deeply interested in Mr. Paul Lupke's paper on "Tape," and may possibly bring out an annotated edition with reference to the Manson brand.

Mr. John H. Dale, of the Dale Company, was most effusive and enthusiastic over the new tungsten fixtures his company is putting on the market. Mr. Dale has just returned from a European trip and knows all about tant and tung.

Habirshaw Wire Company, of New York, was represented by general sales manager Mr. J. B. Olson, who had with him several samples of a remarkably resistive non-abrasive wire for running through trees. The outer coatings are extremely tough, and practical tests show it to be enduring to a phenomenal degree.

The Fort Wayne Electric Works showed its type K meters, meter calibrator, fan motors, drill motors, small induction motors and a portable motor for drilling purposes. The drill motor is fitted with a handle and chuck in such a way that it can be conveniently carried to any location in the building. The company also showed a number of adjustable wall brackets for fans. Representatives of the works included F. S. Hunting, A. A. Serva, W. J. Goll, T. J. Ryan and W. C. Knight.

National Electric Lamp Association.—The engineering department of the National Electric Lamp Association showed a number of tungsten and tantalum lamps and made demonstrations of a 25-watt tantalum lamp. This lamp, as shown, gives 12½ cp from a bulb of the same size as the ordinary 8-cp carbon lamp. The ordinary Edison base is used. The representatives of this company gave practical demonstrations, attempting to refute the theory that the tungsten lamp is fragile, by rigging a small automobile tungsten lamp on a vibrator in such a way that it was given severe jars without breakage. Mr. S. E. Doane, chief engineer, was present in the association's interests.

The Sangamo Electric Company exhibited a working model of direct- and alternating-current meters. The meters were mounted on marble panel slabs. The company also exhibited a cabinet of the essential parts of the meters, showing in detail the parts which go into the construction of the apparatus; also a type F alternating-current meter, which was exhibited for the first time, and a Mercury motor meter, which has the same general features as the motors heretofore manufactured by the company. The special features of this meter are its extremely high torque and its improved mechanical construction and fine adjustments. The Electric Applicance Company, distributing agents for the Sangamo Electric Company, aided that company in demonstrating the valuable points of the Sangamo meters. The affairs of the companies were looked after by Messrs. F. J. Alderson and L. C. Lamphier.

General Electric Company.—The booth of the General Electric Company attracted the usual amount of attention. The company showed several new devices, among which was an aluminum cell lightning arrester, commonly known as an electrolytic lightning arrester. The arrester on exhibit was made for a 12,500-volt circuit, but the company manufactures this type of arrester for taking care of voltages up to 120,000. The cones of the electrolytic arrester are built up on a single standard and are mounted in oil tanks. The cones are partially filled with a suitable electrolyte, the normal voltage for each cell being 400. When the voltage exceeds the normal, or 400, the film which is formed on the surface of the aluminum cone is punctured and allows the normal current to pass to the ground through the cells. The discharge capacity of the aluminum cell is approximately 1000 amp per square inch. In the manufacture of the cones, the materials are treated to an acid bath, which forms a thin film on the surface of the cone. This film has a counter e.m.f. of 400 volts. When a discharge takes place, the film becomes thicker, due to the flow of current. When the film becomes thick enough to make the counter e.m.f. of the cell higher than the line voltage, the discharge ceases. The action of the electrolyte on the film reduces the film to its normal thickness, when it is again ready for another discharge. In addition to the arrester, the company had on display a horn-gap disconnecting switch. This switch is provided with an auxiliary antenna for charging up the arrester periodically. An oscillograph record showing graphically various curves and changes due to reactance, capacity, etc., was also shown. Other things exhibited at the booth were large and miniature tungsten lamps, a full line of electric-heating devices, meters, flame- and magnetic-arc lamps, new developments in small motors, sectional fuses, type H, form H transformers and tungsten street-series lamp brackets with radial-wave diffusers. Two 250-watt tungsten lamps, the first of this large size exhibited, were among the lamps lighting the exhibit. Among the representatives of the company were the following: E. W. Rice, Jr., J. R. Lovejoy, C. D. Haskins, P. D. Wagoner, F. G. Vaughan, D. R. Bullen, E. E. Gilbert, W. L. R. Emmet, C. W. Stone, N. R. Birge, C. B. Burleigh, C. P. Steinmetz, J. W. Kirkland, Theo. Beran, A. D. Babson, H. J. Buddy, A. D. Page, T. E. Bibbins, F. H. Gale, G. L. Thompson, D. B. Rushmore and F. W. Willcox.

FIG. 1.—EXHIBITION HALL, LOOKING WEST.

FIG. 2.—NORTH END OF EXHIBITION HALL.

THE CONDIT CIRCUIT BREAKERS were spoken for by Western Manager Fisher.

THE DUPLEX METALS COMPANY was represented by Avery P. Eckert, sales manager.

MR. D. J. BURNS was on hand looking after the interests of the Ward Leonard Electric Company.

E. H. KELLOGG & COMPANY'S cylinder oils were well spoken for by E. T. Brawley, who has many friends in the electrical and power fields.

PRESIDENT KENYON, of the Diehl Manufacturing Company, attended the convention. This is the first one in three years which has been favored with his presence, but not from lack of interest.

THE ELECTRIC SERVICE SUPPLIES COMPANY showed a number of samples of the Locke insulator, including one of the suspension type, designed for use on a 100,000-volt transmission line. The company also exhibited Garton-Daniels lightning arresters, Sampson cordage, arc lamp suspension cord, a line of strain insulators and a Keystone lamp guard. In attendance were Messrs M. S. Earl and E. R. Mason.

THE SIMPLEX ELECTRIC HEATING COMPANY exhibited an electric range, waffle iron, percolator, flatirons, coffee and teapots, heating pads, sterilizers and traveling outfitters' heaters. This latter heater is so constructed that the stove can be packed inside of the utensils. Mr. James I. Ayer was in charge and was assisted by Messrs. H. R. Hixson, J. N. Macalister, E. R. Jacobs, Roger Williams and J. G. Brobeck.

THE AMERICAN DISTRICT HEATING COMPANY explained to visitors the value of its heating system. Models of underground construction for district heating in connection with heating systems where exhaust and live steam is used, were shown. The company also showed condensation meters used for weighing condensation for selling steam on the meter basis of charge. This device is known as the "watch-dog of the treasury." Various fittings and devices used in connection with central-station heating were shown. One of these fittings is of recent design and is used in making variable joints in steam pipes. Those in attendance looking after the company's interests included Robert Hall, H. C. Kimbrough, H. C. Eddy, H. Zuckerman and J. A. Bendure.

FIG. 3.—EXHIBITION HALL, LOOKING EAST.

THE WESTERN ELECTRIC COMPANY exhibited a number of types of arc lamps, including the lamp with the "Trimming Indicator." The indicator of this lamp is so arranged that it drops down automatically when the carbons have been used up, thus doing away with the danger of having a large waste from the removing of partially burned carbons. The lamp is intended to burn 24 hours without attention. The company also showed a short arc lamp which had a total height of 20 inches. This lamp is especially adapted for use in buildings where the ceilings are low so as to obtain the best possible distribution of light. They also showed a working model of an intercommunicating telephone system. This system is devised to allow the various departments of the central station and the company's offices to be connected and called without the aid of a special operator, simply by pushing a button. There was also shown in the booth a line of Universal fan motors which can be utilized for desk and wall purposes. The interchangeable feature of this fan is dependent upon a split base, the bottom of which can be removed or added to the fan part at leisure. Other apparatus shown were 3-hp direct-current and 2-hp induction motors; also a sample line of wire grips for construction purposes. The company distributed souvenirs during the convention. All of its sales managers were in attendance, and Mr. H. M. Post had automobiles running between the company's Hawthorne works and Chicago every hour during the day to take those who cared to visit the company's factory.

THE WESTINGHOUSE EXHIBIT occupied space in full view of the elevator landing at the entrance to the exhibition hall. The company exhibited, among other things, its heating apparatus, into which field it recently entered by the acquisition of the Hadaway Electric Heating & Engineering Company, formerly of New York. The apparatus that was exhibited in this line was taken from regular stock, and comprised a 2-qt. glue pot, 15-lb. narrow tailors' goose iron, an 18-lb. wide tailors' goose iron, some 5- and 7-lb. sad irons, and a 5-in. x 7-in. veluring stove, such as is extensively used in the finishing of silk hats. Parts of the electric sad iron were dis-assembled to illustrate their substantial construction. A full line of Westinghouse arc lamps was displayed, as well as fan motors, including 16-in., 12-in., and the latest style of 8-in. fans, with a full line of current-measuring instruments for switchboards. Meters and portable electrical instruments were also shown. The exhibit was lighted by Westinghouse tungsten lamps arranged tastefully around the exhibit and on a wheel which was kept revolving. The greatest novelty of the Westinghouse exhibit, however, was the line of tungsten lamps of low candle-power used together with auto-converter reducing sockets. These lamps are of 8, 12 and 20 cp, taking 1.25 watts per candle, and operating at 25 volts. The reducing socket, which is an auto-converter in a neat brass shell, reduces from 100 to 25 volts for this purpose. The list price of these sockets is $3. The type A single-phase motor, which is automatically self-starting with full-load torque, was also shown. The rotor contains an automatic clutch which picks up the load after the motor has started. The company was ably represented by Messrs. S. Q. Hayes, E. T. Penrose, W. B. Wilkinson, G. M. Bates, Samuel Chase, C. E. Miller, W. P. Jend, J. A. Britt, C. F. Medbury, H. P. Davis, T. P. Gaylord, G. B. Griffin, C. B. Humphrey, S. L. Nicholson and C. S. Cook. The Westinghouse Machine Company was represented by J. R. Bibbins and C. C. Chapelle, and the Westinghouse Companies' publishing department by J. C. McQuiston.

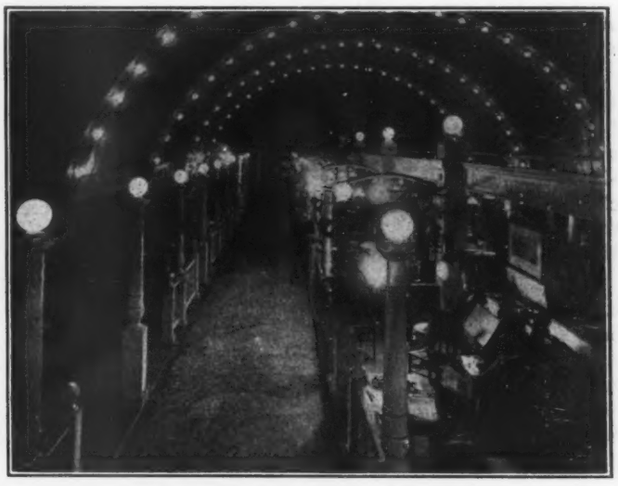


FIG. 4.—SOUTH END OF EXHIBITION HALL.

The Shedd Electric Manufacturing Company had Manager Shedd in attendance.

The National Carbon Company was represented by A. E. Carrier, sales manager, of New York.

One Hundred Per Cent.—This was the thirty-first convention and T. H. Brady, of New Britain, Conn., has attended thirty-one of them.

Mr. W. J. Wallace, president of the Eck Dynamo & Motor Company, looked out for the success of its line of fan motors and power motors.

The Shelton Electric Company exhibited vibrators and hot and cold airblast hair dryers. The exhibit was in charge of Mr. W. G. Shelton.

The Hauserman Metal & Manufacturing Company, which makes nameplates for machinery, made a neat little exhibit and gave away nameplate souvenirs.

G. M. Gest showed at his booth photographs of installations of underground conduit systems as made throughout the United States. Representatives of Mr. Gest were Messrs. J. A. Doyle, W. T. Jackson and E. D. Tillson.

The German-American Electric Company gave a continuous demonstration of its flaming arc lamps. Twelve lamps were in service nearly all the time during the period the exhibit hall was open. This company's lamps are of the gravity-feed type. Lambert Schmidt, president, was in charge.

The Sprague Electric Company exhibited its well-known R. T. motors, flexible steel armor motors, fans, flexible conduits and fittings and stamped steel boxes and fittings. The company had quite a staff representing it at the convention. Among these were Messrs. A. Anixter, D. I. Cooke, H. H. Hornish, E. B. Kittle, J. F. Richards and E. M. Terwin.

The Pittsburg Transformer Company exhibited its standard and efficient high and low-tension type of transformers. Marked improvements have recently been made in the efficiency of transformers by this company through the adoption of the new silico-vanadium steel in the manufacture of the cores. It is claimed this steel reduces the core losses from 30 to 40 per cent below former figures. Mr. C. L. Leininger, Miss Lake and H. G. Steele were in attendance.

The Duncan Electric Manufacturing Company's exhibit consisted of house type and several styles of switchboard wattmeters. A graphic recording wattmeter, being the latest Duncan development, attracted the interested attention of engineers generally. This instrument was shown in operation as adapted to totalizing the entire output of a plant on one meter, including all types of generators, such as different voltages on direct current, single-phase, two-phase and three-phase alternating current. It is claimed to be the only known system whereby this result can be accomplished. The exhibit was in charge of Adrian Tobias, assisted by J. Clarke.

Wagner Electric Manufacturing Company.—At the booth of the Wagner Company were shown a 5-hp single-phase motor of late design, a 10-hp polyphase motor and a set of standard Wagner instruments. The large material allowance and ample weight of the larger motor in comparison with many other motors of the same capacity attracted much favorable comment. The attractive exterior finish of the Wagner motors, as well as their interior efficiency, have come to be almost a trade mark of the company. Among the many representatives of the company present were Messrs. V. W. Bergenthal, W. B. Clarke, D. Emerson, B. Faxon, E. W. Gownheindt, E. W. Goldschmidt, A. H. Mustard and T. T. Richards.

Central Electric Company.—The exhibit of the Central Electric Company consisted of a complete line of new Lexington high-tension porcelain insulators; a working exhibit of the universal flat rate controller which is attracting much attention with the use of tungsten lamps; a full line of D & W fuses, cut-out boxes, B. A. remote-controlled switches, and the Okonite products for which the company is general Western sales agent. A complete line of International indicating instruments and S. E. automatic circuit-breakers were attractively mounted into working exhibits. Among the company's representatives in attendance were Messrs. C. E. Brown, F. R. Bryant, H. Caird, W. M. Hincher, C. J. Kadau, G. A. McKinlock and A. Mungle.

The General Storage Battery Company exhibited at its booth samples of the "Bijur High Duty" Planté battery plates. These plates are constructed of cast-lead grills firmly welded into a gridiron frame. Owing to a special permanization process, the negative plates retain their original capacity indefinitely. The design of the grill for both the positive and negative plates permits a free circulation of the electrolyte entirely through the plate, thus reducing the voltage changes, and allows for ample expansion room, thus rendering the plates non-buckling. The General Storage Battery Company also manufactures the Bijur regulator, which, when used in connection with a battery and generating plant, reduces all fluctuations to a steady average load. Mr. A. Bradley was in attendance.

The Triumph Electric Company exhibited its new automatic starter for induction motors, recently placed on the market, which has already attracted a great deal of attention. The starter is so arranged that it is impossible to leave the switch in the starting position. The fuses attached to the starter are not in circuit while the blades of the switch are in starting position. When the handle of the switch is released, the switch automatically flies to the running position and throws the fuses into circuit. The transformer and the switch base are made up into one unit. The company has also brought out recently a switch of the same type as the above for use on small-sized motors which do not require transformer starters. Several motors, ranging in size from 1 to 40 hp, were also shown. The company was represented by Messrs. J. C. Hobert, W. H. Jacobs, C. S. Reno, S. Senstius, E. S. Ford and F. L. Merrill.

The Federal Electric Company was busy all the week demonstrating the new Willis straight-line meter, of which this company is the sole distributor. Five of these meters were on exhibition at the Federal Company's booth. This is a commutator type of meter. The following are a few of the advantages claimed for the meter: The 600-watt size starts on 2 watts. It cannot be successfully tampered with. It is the only meter on the market which registers on a cyclometer dial in numerals instead of by pointers. Its current consumption on potential in all 110-volt sizes averages only 2 watts. It is a zero-temperature coefficient meter. Its cyclometer integrating index has instantaneous-action number-wheels. It does not creep on potential and is absolutely at rest when a customer's light is not on. The several styles of Federal clusters for tungsten lamps, which have been adopted as standard by many central stations, as well as the company's regulation porcelain enameled steel electric sign, were also on exhibition. Mr. J. M. Gilchrist, general manager of the company, looked after the company's interests and was assisted by H. I. Markham, L. G. Shepard, H. F. Willing and S. C. Wackenfeld.

The Minerallac Company showed a line of insulating compounds and electric specialties. The most important of the exhibits was a printing attachment for recording wattmeters. This attachment prints the registration of the integrating wattmeter at intervals of 15, 30 or 60 minutes, as desired. It enables central-station men to construct a load curve for each customer with accuracy, thus obtaining all the essential information upon which to base rates to power consumers. It is claimed this attachment is more accurate than a graphic recording meter, and as it prints the registration in plain figures, disputes regarding the reading are eliminated. The company also exhibited the Excello flaming-arc lamp, for which it is special agent for Cook County. A 440-watt miniature arc lamp, giving a mean hemispherical candle-power of 600, which is the latest production of the Excello Arc Lamp Company, was also shown. The Minerallac insulating compound has been especially developed by this company for high-tension and underground cable jointing. By means of it several men from large central stations claim to have entirely eliminated cable-joint failures. The exhibit was in charge of Mr. R. F. Pierce, assisted by Mr. W. E. Pemberton.

THE SWITCHBOARD EQUIPMENT COMPANY displayed its single-pole circuit breaker.

HUGO REISINGER and "Electra" carbon were looked after by Manager C. A. DuBosch.

MR. HARRY P. MOORE, sales manager for Chase-Shawmut Company, vouched for the well-known specialties of this company.

AMERICAN ELECTRICAL WORKS sent Mr. F. E. Donohue, of the New York office, to look after its interests, not only in the convention, but at golf tees and five o'clocks.

THE FRANKLIN ELECTRIC MANUFACTURING COMPANY, with factories at Hartford and Middletown, Conn., was represented by P. S. Klees and Western representative Thorpe.

THE STANDARD PAINT COMPANY distributed literature describing P. & B. paint, electric compounds, varnishes and tapes. The interests of the company were looked after by Mr. B. C. Beckman and Mr. E. F. Engle.

THE AMERICAN ELECTRIC HEATER COMPANY distributed from its booth a souvenir paper weight which was an exact miniature reproduction of the company's 7-lb. flat-iron. The representatives were Messrs. B. H. Scranton, Robert Kuhn, Frank Kuhn, E. Dewey and Bert Dewey.

THE W. D. MCJUNKIN ADVERTISING AGENCY exhibited sample advertisements and cards relating to electric light service, such as this company writes for central stations. Those who demonstrated the efficacy of the concern's advertising methods were Messrs. J. Brown, J. Benson and W. D. McJunkin.

THE CHICAGO PNEUMATIC TOOL COMPANY gave at its booth a practical demonstration of the Duntley electric vacuum cleaner. The cleaner exhibited was equipped with a one-sixth horse-power motor and a special double-acting piston pump with a 7-in. cylinder and a 1-in. stroke. The weight of the machine is about 60 lb.

THE D & W FUSE COMPANY showed non-arcing fuses and fuse boxes. Owing to the ill-health of Mr. L. W. Downes, the general manager, Mr. Sisson, who usually attends the convention, was unable to be present. The company, therefore, was without direct representation, but its various agents took care that it did not suffer in this respect.

THE PHILADELPHIA ELECTRIC & MANUFACTURING COMPANY called special attention to its rust-proof paint. The company showed a large line of incandescent street light fixtures for tungsten lamps, a line of underground appliances, such as fuse boxes and metallic wrappers, and its general line of arc lighting appliances. Mr. A. H. Manwaring was in charge of the exhibit.

THE CHICAGO FUSE WIRE & MANUFACTURING COMPANY showed a large supply of enclosed fuses and blocks, sectional switch boxes, conduit boxes and covers. The display was mounted on very neat display cabinets, such as are furnished customers by the company. Among the company's representatives were Messrs. S. S. Merrill, C. T. McDonald and W. W. Merrill.

DOSSERT & COMPANY, INC., exhibited a full line of Dossert connectors, including a number of new devices for heavy cables for central-station work. One of the principal exhibits is an equalizer, as used on the Williamsburg Bridge of New York, to equalize the voltage between two cables on a positive feed. In this case the two feeders are joined without being cut. The cables carried are of 2,500,000 circ. mils cross-section each. Messrs. H. B. Logan and C. A. Flynn represented the company.

OTIS ELEVATOR COMPANY.—An automatic elevator of very interesting design was exhibited by the Otis Elevator Company. The exhibit shown was especially adapted for service in hospitals, residences and apartments. This company furnishes elevators which may be operated by direct current, single-phase and polyphase current. The movement of the elevator is governed entirely by a single push button. Messrs. W. J. L. Banharn, C. G. Comstock, Jr., M. H. Christopherson, W. N. Dickinson, H. A. Fulton, G. R. Fiedler, E. M. Hill, A. A. Merrill, J. H. Miller, O. E. Nord and F. S. Porter were in attendance.

STUDEBAKER AUTOMOBILES.—Because of the absence of a proposed exhibit of the Studebaker Automobile Company, that company will undoubtedly obtain as good results through publicity as though it had been possible to make the exhibit. The company planned on exhibiting one of its well-known electric wagons, but it was found impossible to get the vehicle into the hall, although a start was made as far as the parlor floor. The company's representatives were very much in evidence during the convention, and took advantage of the publicity gained by their inability to get their exhibit into the hall. J. A. Coittenden was in attendance.

THE ELECTRICAL WORLD was most conveniently located in the exhibit hall, its booth being immediately opposite the entrance to the meeting room. It is needless to say that the issue of May 16, with over 350 pages, by far the largest number of an electrical journal ever issued, attracted much attention and many admiring comments, one delegate hailing it as the "herald of our new prosperity." The 18-page article on the Commonwealth Edison system was very timely. An exhibit was made in the booth of electrical books published by the McGraw Company, particularly the new edition of the Standard Handbook for Electrical Engineers, of which work over 6000 copies have already been sold. The new *McGraw Electrical Directory*, listing over 5000 central stations, was also in demand. The paper was represented by Messrs. Wakeman, Martin, Cravath, Church, Elliott, Caldwell, Hunt, Hitt, Mock, Doyle and Wadsworth.

THE VULCAN ELECTRIC HEATING COMPANY exhibited soldering irons in various sizes, iron heaters, electric meat inspection branding irons and electric Marcel waving and curling irons. The curling irons shown were among the most interesting things seen in the exhibit halls. They are identical in shape and manipulation with the regular Marcel waving tongs used by professional hairdressers and possess all their merits. They have automatic regulation, which maintains the temperature continuously at a point which is absolutely safe for use on the hair, and they have flexible cords attached by a swivel arrangement which allows perfect freedom of operation. The handle is overbalanced so that the heated portion of the tool is automatically lifted clear of the dresser top. The handles are covered with insulating material to prevent the hand from being burned by the heated tool. The continuous heating referred to incidentally gives the benefit of steady work without interruption. They are much more cleanly than those heated by gas flame. The representatives of the company claim that the best possible proof of the superiority of the device is shown by the fact that the Marcel wave produced in the hair by its use has been shown to last 50 per cent longer than waves made by gas-heated Marcel irons, because ideal temperature is maintained in the iron at all times.

THE G & W SPECIALTY COMPANY exhibited at the booth of the Electric Service Supplies Company six types of potheads for single and multiple conductors. The exhibit was installed on a miniature pole located at the rear of the booth, showing the exact method of installation. The method of making connections between underground cables and overhead lines and the typical use of potheads for central-station purposes, attracted a good deal of attention. The disconnecting feature of the pothead is one of the strong arguments presented by the company for its adoption. The company also had on exhibition a line disconnector, which is designed to eliminate the use of cradles or guard wire networks, where lines of high voltage cross telephone and other wires. The disconnector works automatically, and is so arranged that if the wire is broken at any point, the broken ends disconnect themselves at the insulators and fall free to ground, thus eliminating the danger of property loss through crossed wires. This company's new grounding cap was also shown. This is for making transformer ground connections with galvanized iron pipe. It serves both as a connector and as a mechanical protection while driving the pipe. The ground wire is slipped under the cap, the cap is placed over the end of the pipe and the pipe driven. The cap is thus forced over the pipe and ground wire so as to make a good electrical and mechanical connection.

The Haller Sign Works, Inc., exhibited on the sixth floor of the Auditorium sample illuminated signs designed to be used for advertising purposes.

The National Automatic Advertising Company exhibited its automatic stereopticon machine, which should be a good source of central station revenue.

The Albert & J. M. Anderson Manufacturing Company showed the Anderson electric time switch for throwing on and off electric signs and for use on other flat rate circuits.

The International Electric Meter Company occupied space in the combined Central Electric and Pettingell-Andrews Company booth. The company exhibited direct-reading meters and station wattmeters. Representing the company were Messrs. W. W. Cheney, A. Benson and J. S. Jackson.

The Universal Manufacturing Company exhibited flat rate controllers, which act to flicker automatically the lamps when the maximum number contracted for is exceeded. There are a number of conditions for which this controller is proving specially suitable, and this company has recently been taking some notable orders.

The Condit Electrical Manufacturing Company displayed in its booth the largest assortment of oil-circuit breakers that has ever been shown at an exhibit of this kind. The circuit breakers manufactured by this company range in capacity up to 1500 amp and are made for voltages ranging from 6600 to 33,000. A pole-line switch exhibited called forth much favorable comment from central station men. Another device that attracted some attention at this booth was the L. S. type of switch, which is used for the protection of small induction motors.

Construction Details of Revolving-Field Alternators.

All apparatus for the modern central station is necessarily of a high grade, but for no part of the equipment is a higher standard set than for the generating units. This fact is particularly evident in the case of alternating-current installations.

The Western Electric Company had until recent years devoted its attention chiefly to the manufacture of direct-current apparatus. The increasing demand from central stations for alternating-current units of large size, however, led to its purchasing a large tract of land at the extreme west of Chicago and erecting shops, affording excellent facilities for the manufacture of all types of electrical apparatus. Immediately the manufacture of alternators was undertaken, and now forms a large part of the company's business.

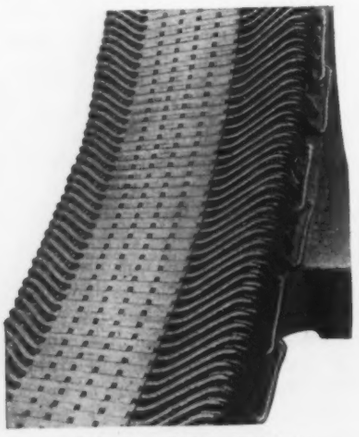


FIG. 1.—STATOR WINDING.

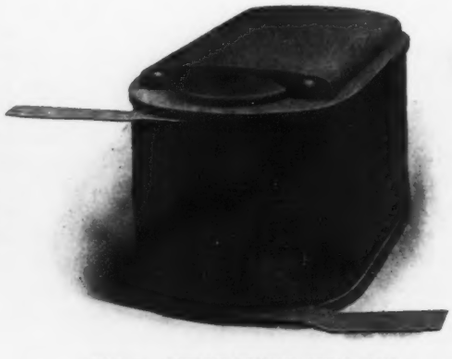


FIG. 2.—RIBBON-WOUND FIELD COIL.

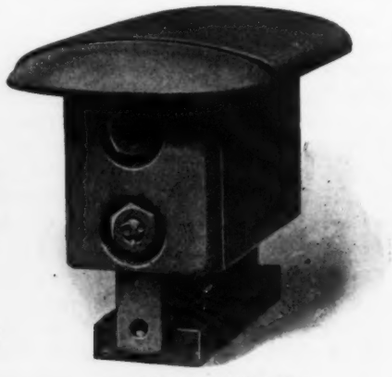


FIG. 3.—POLE CORE.

The accompanying illustrations show some of the features of the alternators built by this company. Fig. 1 is typical of the stator winding of all types of machines. The radiating surfaces, as shown, are large and well exposed to the windage of the rotating field. The ribbon-wound field coil, shown in Fig. 2, is used on the larger machines, and practically all of the engine type machines. This scheme gives good radiation and also brings the flat surface of the strip in a position to resist the stresses due to the centrifugal effect produced by the rotation of the fields. Fig. 3 shows the pole core used on the belted type machine. These poles carry a wire-wound coil, which is impregnated after winding under vacuum. The losses in the pole are kept low by using laminated sheets of metal in their construction. Fig. 4 shows the laminations of which the rotor

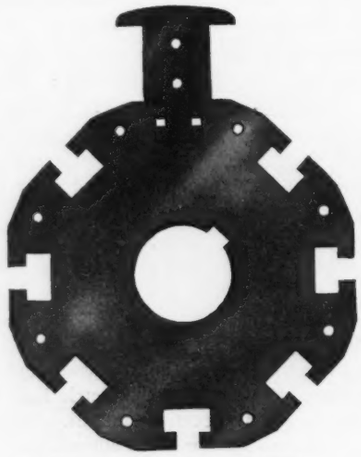


FIG. 4.—ROTOR LAMINATION.

used on the belted and high-speed water wheel type machines is constructed. A single lamination of the pole is also shown, which illustrates the method of construction. The completed pole is held in position by double taper keys.

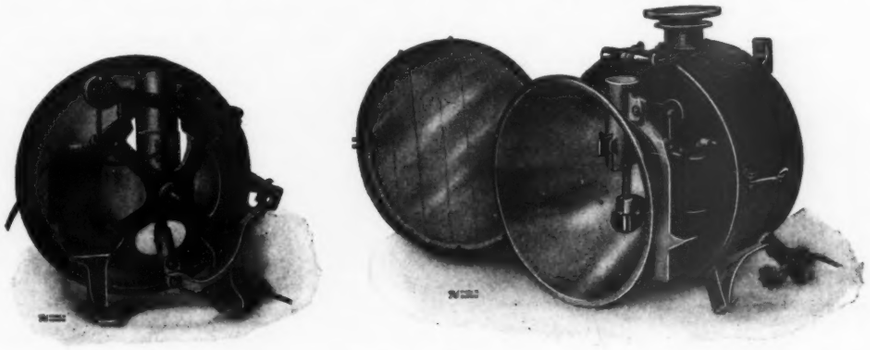
New Use for Manganese Steel.

A good example of how the development of one industry helps another is found in an order for manganese steel disks recently placed by the Cutler-Hammer Clutch Company, of Milwaukee. This company, in addition to manufacturing magnetic clutches, makes a specialty of lifting magnets for handling pig-iron and scrap metal. The growth of this latter business and the natural desire of the manufacturers to perfect every detail of their product has led to the adoption of manganese steel for coil shields—the coil shield being the flat disk fastened to the under side of the lifting magnet for the double purpose of protecting the magnetizing coil and interposing between the two poles of the magnet an area of non-magnetic material. Brass, which is non-magnetic, has heretofore been used for this purpose. Ordinary steel will not do because it is a magnetic metal and would serve to conduct the magnetic lines of force from pole to pole, instead of compelling them to seek a passage through the material to be lifted. Manganese steel seems to be the ideal metal for this purpose. It is non-magnetic, like brass, and infinitely harder—so hard, in fact, that

the continued hammering of the pig-iron or other metal on the under surface of the magnet makes not the slightest impression on it. The 50-in. magnets recently furnished by the Cutler-Hammer Clutch Company to a number of steel mills in the Pittsburg district are all equipped with manganese steel coil shields instead of with the brass coil shields formerly used.

Luminous Arc Lamp for Electric Car.

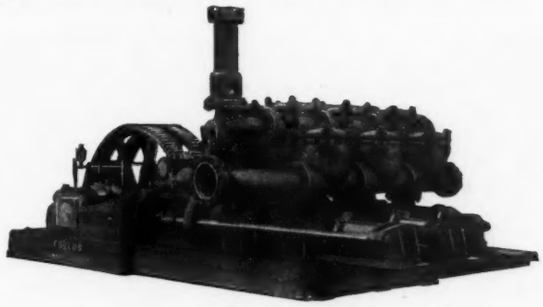
The accompanying illustrations show an arc lamp for use on railways cars, for which many advantages are claimed over the carbon-arc lamp. The upper electrode of the lamp is a copper forging and the lower electrode is an iron tube filled with a special composition. Thus the lamp is of the so-called "luminous arc" type. In the top of the lamp casing is an opening for a draft tube on the top of which is a hinged cast-iron cover which protects the arc from wind and rain. The parts of the mechanism are attached to an aluminum frame in such a manner as to render the parts readily accessible. The reflector, which is of the parabolic type, is made of spun brass heavily nickeled. A dimming effect for application through thickly-populated districts is obtained by reversing the polarity of the electrodes of the lamp. It is stated that the life of the upper electrode is from 2000 to 3000 hours, and that of the lower from 50 to 75 hours. This lamp has been placed on the market by the General Electric Company, Schenectady, N. Y.



FIGS. 1 AND 2.—MECHANISM OF LUMINOUS ARC LAMPS.

Mine Pump.

The Goulds double-acting, triplex plunger mine pump was originally designed for mine service, but has since been adopted for various duties. It is said to have proved particularly effective in accumulator work or where constant high pressures combined with large capacities have to maintained. The construction is such that the pump can be taken to pieces and lowered through an ordinary mine shaft, and when assembled requires but little head room. It is built to withstand continuous hard service under the most exacting conditions, all working parts being easily reached from the outside without dismantling, and is particularly adapted for operation by electric power.



MINE PUMP.

The frame consists of two heavy, cast-iron bed plates, doweled together and supporting the main bearings, guides, cylinders and all working parts; the crank shaft is of forged steel in two pieces, each having a single throw with a gear at the inner end to carry the center crank pin; the crank shaft bearings are babbitted, hammered and bored to secure perfect bearing surface, and have wedge and screw adjustments of special construction to keep the shaft in alignment. The pinion shaft bearings are of babbitt metal; the double gears are of charcoal iron, the pinions being steel forgings, both machine-cut from the solid; the crossheads are fitted with adjustable shoes which are babbitted and run in bored guides; the connecting rods are of steel with forged steel strap and wedge adjustment with bronze boxes at each end; the six cylinders are all of separate charcoal iron castings fitted with bronze linings; the plungers are of hard cast-iron, carefully machined and ground true and smooth, outside packed; the glands are of hard cast-iron and easy of access for adjusting and repacking. The valve boxes are of separate charcoal iron casting, each containing a set of suction and discharge valves which are easily examined by the removal of the valve box covers. Power for driving may be applied at either side of the pump. For electric power intermediate gearing and auxiliary shaft are provided. The pump is made by the Goulds Manufacturing Company, Seneca Falls, N. Y.

Single-Phase and Polyphase Motors.

The accompanying illustration shows a type of motor arranged especially for driving machine tools. The flanges on both sides of the motor are machined, and they are drilled and tapped at 30-deg. intervals so as to make the direct application of the motor to the driven machine possible in any position. Moreover, the frame of the motor is such that it may be used with the special support employed for attaching direct-current motors to the machines.

It is stated that in the design of these motors high efficiencies have been obtained by the liberal use of the active materials; low temperature rise is assured by providing adequate ventilation, while the power factor is kept high by employing partially-closed slots and small air-gaps. In order to eliminate the trouble sometimes encountered with motors having small air-gaps special attention has been given to the shafts, which are very rigid and supported very close to the rotor. The bearings

THREE-PHASE INDUCTION MOTOR.

are made of phosphor bronze and are of the ring-oiling type, each bearing being provided with two oil rings.

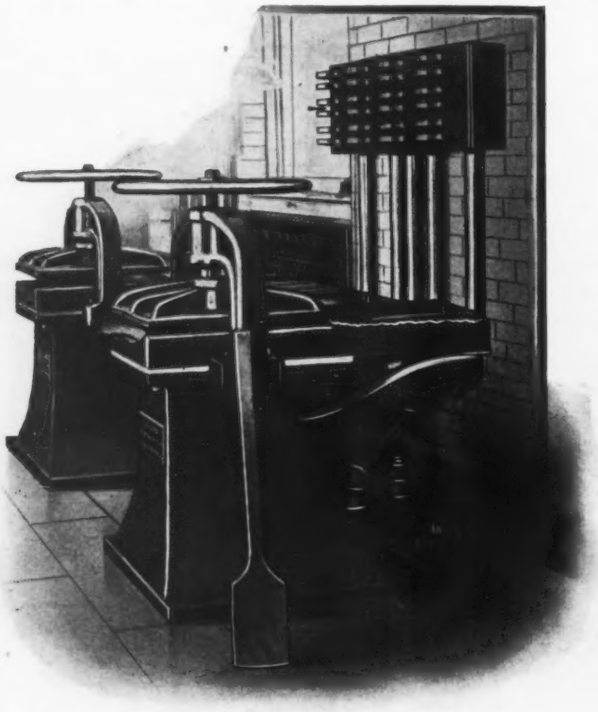
For constant-speed work the motors are provided with squirrel-cage secondary windings on the rotors. For variable-speed duty, such as driving printing presses, the motors are provided with coil-wound rotors, variable resistance being inserted in the secondary circuits for changing the torque-speed characteristics.

The single-phase type of motor is practically the same as the polyphase motor in external appearance, but it has a combined induction-motor and repulsion-motor winding on the rotor. It is stated that this machine possesses a large starting torque, and runs at a high power factor with low temperature rise.

The above-described motors have been placed on the market by the Jenney Electric Manufacturing Company, Indianapolis, Ind.

Electric Heat Applied to Stereotyping.

A striking example of the advantages of electric heating over steam or gas heating is afforded by the Hadaway electrically-heated stereotypers' matrix dryer. The stereotyping process in every newspaper office is one in which the time element is of the greatest importance. Every minute counts and much experimenting, at great expense, has been undertaken for the sake of reducing the time. With the other methods developed to the utmost, the electric method shows a saving in time of from 50 to 60 per cent. In addition to the saving in time, the Hadaway matrix drier possesses a number of other advantages. The bed which contains the heating element is solid and has no tendency to give like the cored bed. The liability of the bed to explode from excessive pressure is entirely eliminated. Electric heat can be more closely regulated and is absolutely reliable.



STEREOTYPERS' MATRIX DRIERS.

The heating element consists of a steel resistance grid, embedded and hermetically sealed in fireproof insulation in a heavy bedplate, immediately below its upper surface. As the result of this construction, the surface of the bed plate attains a very high temperature and the solid metal below serves as a thermal storage reservoir. The cold form draws the heat very rapidly from this surface, so that the type is very quickly brought to the temperature required to thoroughly dry out the matrix. The grid is practically indestructible. The fireproof insulation does not deteriorate when continually subjected to high temperatures. It has a high dielectric strength and good heat-transmitting qualities. This device is manufactured by the Westinghouse Electric & Manufacturing Company.

A New Line of Direct-Current Portable Instruments.

A new line of direct-current portable instruments, known as type DP, has been placed on the market by the General Electric Company. This type of instrument has been designed especially for laboratory and general testing purposes, and includes a complete line of ammeters, voltmeters, milameters and milli-voltmeters with the necessary portable shunts. These instruments are constructed on the well-known D'Arsonval principle, the coil of wire carrying the current to be measured, or a shunted portion of it, being wound on a rectangular frame mounted on jeweled bearings. This frame is free to move in the annular space between a soft iron core and the pole pieces of a powerful permanent magnet.

The case enclosing the mechanism of the instrument is of drawn steel with a cast iron cover, thus thoroughly protecting the instrument from the influence of stray fields. The magnets used are of the highest grade of magnet steel obtainable, and their permanency is assured by improved processes of ageing and hardening. High torque is secured through efficient design. The scales are uniform throughout their entire range and are very legible. To eliminate errors due to parallax, the instruments are equipped with flat pointers viewed on edge and a mirror is placed under the scale.

The ammeters are made self-contained in capacities up to and including 30 amps. For higher ranges up to 2000 amps. a milli-voltmeter with scale marked directly in amperes is used with a portable shunt. These shunts are designed to give a uniform drop of 200 milli-volts at full-load rating, and are, therefore, interchangeable. The milli-voltmeters used with these shunts are also interchangeable. The portable shunts are mounted on a base of aluminum alloy and are protected by a perforated sheet metal casing. This gives a very light and durable construction. They are furnished with a leather handle to facilitate transportation. If desired, two or three shunts can be furnished combined in one case.

MILLI-VOLTMETER WITH SHUNT.

When an instrument is desired for a class of work which does not require extreme precision, a milli-voltmeter of this type can be used in connection with switchboard shunts, the instrument giving full scale deflection when subjected to a 60 milli-volt drop in potential; or a tap may be brought out at 60 milli-volts on the standard 200 milli-volt voltmeter, enabling it to be used with both portable and switchboard shunts. Where it is desirable to use one instrument to cover a wide range of current, a milli-voltmeter can be employed with any combination of single, double or triple rated shunts. The standard capacities of the portable shunts have been so selected that regardless of the capacities chosen, the scale readings may be quickly determined.

The voltmeters are furnished self-contained in capacities up to and including 750 volts, and with either single or double scales. Instruments for measuring very low voltages and currents have scales marked in milli-volts and mil-amperes.

Combined Electric Carpet Sweeper and Vacuum Cleaner.

A very serviceable cleaning device which at once meets the requirements of the ordinary home as well as those of the largest public building is shown herewith. The renovator is constructed of aluminum with the exception of the motor, which is of standard construction. The vacuum is produced by a centrifugal exhaust fan driven directly by the motor without intermediate gears. The entire outfit is portable, being mounted on wheels and being provided with a handle for moving it about. Its operation is as follows: At the bottom and in front of the machine is a rotary brush driven by a small belt from the motor. As the machine is moved over the surface to be cleaned the brush loosens all the clinging, tight dirt and smooths and straightens out the nap or pile of the carpet. A strong suction of air works around this brush and carries the dirt and dust in the collector at the rear. In addition to the great amount of work accomplished by the rotary brush, hose connections are provided which may be used in conjunction with or independent of the cleaning with the brush. The non-collapsible hose is fitted with a nozzle or tool at one end and to the suction at the other end. As the tool passes over the surface to be cleaned the dirt and dust are sucked up, passing up through the hose to the collector. The latter is removable, so that the accumulations can be dumped into some receptacle for final disposition. By means of the hose attachments every crevice can be reached and dust can be removed from every article used. Not only can the floors and rugs be thus cleaned, but pictures, curtains, blankets, beddings, trunks, etc., can also be deprived of dust by the same means. By reversing the hose connection, the air current is reversed, and air under pressure can be used to freshen up bedding after it has been cleaned. The machine is practically noiseless in operation, and since there are no pumps, plungers or cylinders, no adjustments are required. The renovator can be equipped with either direct- or alternating-current motors, which are supplied with energy through a flexible cord attached to a standard socket. The renovator's wide range of usefulness makes it one of the most serviceable of household devices, and its mechanical simplicity has commended it to central-station managers as a valuable addition to energy-consuming devices. The cost of operation is said to be very reasonable. The machine is manufactured by the Electric Renovator Manufacturing Company, of Pittsburg, Pa.

ELECTRIC CARPET SWEEPER AND VACUUM CLEANER.

Mercury Rectifier Battery Charging Outfits.

As is well known, the mercury rectifier provides a means of converting alternating current into direct current without the use of any moving machinery. The commercial applications of rectified alternating current for various purposes during the last few years have proved satisfactory and are steadily increasing. The Westinghouse Electric & Manufacturing Company has recently introduced a number of improvements in the details of the Cooper Hewitt mercury rectifier. Fig. 1 shows a rear view of a rectifier panel used for battery charging. The essential apparatus consists of an auto-transformer, a two-pole, alternating-current knife switch, a starting switch, a shunt and starting resistance mounted in one case, a regulating reactance, rectifier bulb, ammeter, voltmeter and direct-current circuit-breaker. The panel is 36 in. high by 16 in. wide, and is supported on a standard pipe frame. The auto-transformer is mounted on the floor directly under the panel; all other apparatus is affixed to the panel. The rectifier bulb is supported in a metal ring having a stem which projects through the panel for convenience in tilting the bulb at starting. Only one size of the bulb is required for any current up to 30 amp direct current, and this bulb may be used on any usual commercial alternating-current circuit. The auto-transformer is designed for 60-cycle circuits. The rectifier outfits for automobile charging are furnished to cover the usual range of 10 to 20 and 20 to 44 cells. They are arranged to operate on standard line voltages of 110 and 220.

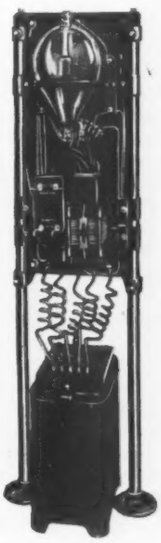


FIG. 1.—REAR VIEW OF CHARGING OUTFIT.

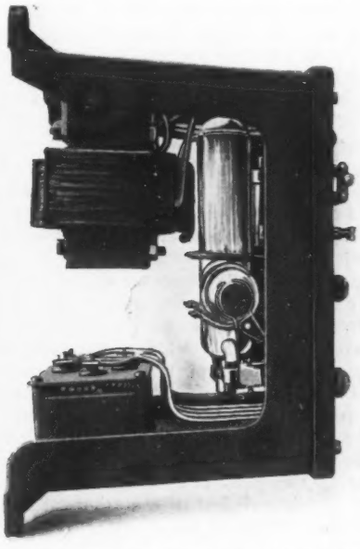


FIG. 2.—SIDE VIEW OF SMALL RECTIFIER PANEL.

Fig. 2 shows an outfit for ignition-battery charging. These sets are made in two ratings of 5 amp and 10 amp, respectively, and each size is arranged to be bolted to the wall. The standard sets are wound for 60-cycle, 110-volt circuits. The smaller size is capable of charging from one to six cells of not over 5 amp rating in series, and the larger size, three to 10 cells of 10-amp rating in series. The essential parts consist of the rectifier bulb, auto-transformer, starting and shunt resistances and regulating reactance. As shown in the illustration, the auto-transformer and resistances are mounted back of the panel within the frame so that they are well protected from mechanical injury. The 5-amp set occupies a wall space of 13¾ in. x 16⅝ in., and the front projects 10 13/16 in. from the wall. The 10-amp panel requires a wall space of 14⅜ in. x 19 in. and projects 12 5/16 in. from the wall. No meters are provided with small outfits.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.—Trade last week reflected the varied weather conditions and was rather "mixed." In some sections of the country there was a slight improvement in both retail and wholesale trade over the preceding week and general business reports, as a whole, were slightly more optimistic. Crop reports from the North and South were much better. Spring wheat is in apparently perfect condition and with increased acreage. Coal and lumber trades show signs of increasing activity, but the textile manufactures are very dull. On May 13, the number of idle cars on the side tracks all over the country was 404,375, which was 8963 less than on April 29, the time of the last report of the American Railway Association. This is the first time in two months that an increase in the number of cars idle has not been reported. The position of the steel trade shows more strength. Buyers in the pig-iron market with good orders at prevailing prices, brought about the long-awaited turn in that metal and sales of pig iron for the week exceeded all transactions since Jan. 1, being conservatively estimated at 100,000 tons. Prices for steel products were reaffirmed at a conference of the heads of leading steel interests during the week, and these figures will hold throughout the summer in all probability. Money is easy, with funds continuing to accumulate in the banks. Bank clearings for the week were greater than for the previous week, showing but a slight decrease from the same week last year. Stock market activity was largely responsible for the bank clearings' total of $2,630,000,000, the largest, with one exception, since the beginning of the year. Collections continue backward but are improved over a month ago. *Bradstreet's* reports 284 business failures for the week ended May 21, as compared with 281 in the previous week, 165 in the corresponding week in 1907, 170 in 1906, 179 in 1905 and 184 in 1904. Electrical interest during the last week centered at the convention of the National Electric Light Association at Chicago, which was largely attended by representatives from every part of the country. The tungsten lamp was fully discussed at the convention, and as a result it is expected that central-station men all over the country will follow the example of the New York companies in putting the tungsten lamp within reach of the consumer. The lamp manufacturers already report a good demand for the lamp, a demand which is steadily growing, and which bids fair, as the station men and consumers become familiar with the properties of the lamp, to be greater than the lamp manufacturers can handle. The business of the Westinghouse Electric & Manufacturing Company is running at about 50 per cent of normal, which is fairly typical of the other large electric manufacturing companies. Most of the electrical business is made up of small contracts.

ELECTRICAL EXPORTS.—For the month of March, 1908, the Government report shows that exports of electrical instruments and apparatus for scientific purposes, including telegraph and telephone instruments, fell off to the extent of $146,457 from March, 1907, when the exports of this class totalled $590,999. For the nine months ended March 31 the totals, while not up to the totals of the same period last year, were considerably over the totals of 1906, when the exports of this class were $4,654,800. In 1907 they reached $6,305,191 and fell to $5,281,944 in the nine months under consideration. During these nine months British North America headed the list with imports valued at $1,065,579, Brazil was second with imports of $960,283 and the United Kingdom third, with imports of $520,081. Exports of electrical machinery, totalling $690,636 for March of the current year, showed a heavy falling off from March, 1907, when the exports amounted to $919,825. The totals for the nine months ended March 31, 1908, however, showed a considerable increase over the corresponding period in 1907 and 1906, being $6,800,048 against $6,375,622 and $5,736,935 respectively, in the two years under comparison. For the nine months ended March 31, 1908, Japan headed the list of the countries importing American electrical machinery, with imports valued at $1,236,142; Mexico was second with imports of $1,137,442; British North America third with $712,411; Brazil fourth with $682,726, and the United Kingdom a close fifth with $652,394. The excellent showing for March of the current year, considering the business situation, and the record total for the nine months ended March 31, is noteworthy in view of the quiet condition of the domestic electrical business, which is estimated at less than 60 per cent of the normal at the present time.

PLANT IN FLOUR MILLS.—During the past year the Washburn-Crosby Company, of Minneapolis, Minn., has built a large concrete elevator, all the machines in which are operated by individual induction motors, ranging in size from 10 horse-power to 75 horse-power. The Westinghouse-Parsons steam turbine furnishes three-phase current at 460 volts. An elevator load varies greatly, so that the load on this turbine runs from 25 per cent to 150 per cent, and as the period of light loads predominates the power factor is very low. In order to help this power factor the company has installed a 150-hp synchronous motor to operate a small mill which it recently built. This motor runs with a 75 per cent leading current. This raises the power factor on the generator very materially and improves the regulation. It is at present installing a 1500-kw Allis-Chalmers steam turbine. This will furnish current for the 1000-hp induction loader, directly connected to the main shaft of a 3000-bbl mill, also for the 400-hp motor which drives the wheat-cleaning house and a 200-hp motor for running a small model mill. The company hopes to have this machinery in operation about July 1.

COPPER GOSSIP, issued by the National Conduit & Cable Company, says: "The principal center of interest in Europe is the standard market. Producers, agents and dealers, as well as speculators, can always count on the ability of the London market to put through any sort of a copper deal that may suit the fancy of the operators who engineer important movements at that point. Sales of refined copper to foreign consumers lately have been on a moderate scale, but with a renewal of activity in the standard market a better demand from manufacturers would undoubtedly develop. An upward movement on the side would encourage European buying for consumption and speculation although professional 'bear' operators may continue to contest the efforts of 'bull' leaders to land prices on a higher level. There are large stocks at foreign centers, and unless consumption improves heavy supplies will remain a feature of the European situation. They represent material secured at low prices, however, and the holders can afford to hang on until the prospect of a profit is in sight. There is a feeling in the trade that the course of the market will broaden and strengthen."

ALLIS-CHALMERS TURBINES.—The Allis-Chalmers Company has just made a shipment of eight turbo-generator units aggregating 9500 kw in capacity. Two 1500-kw units were shipped to the Youngstown (Ohio) Sheet & Tube Company; one 1500-kw unit to Jacksonville, Fla.; one 500 and one 1000-kw unit to the Celluloid Company, of Newark, N. J.; one 1500-kw unit to the Tremont and Suffolk Mills at Lowell, Mass.; one 1000-kw unit to the Athens Electric Railways of Georgia, and a similar unit to the Nairn Linoleum Company, Kearney, N. J. Since these shipments orders have been received for a 500-kw turbo-generator unit from the city of Austin, Tex., and for a similar unit from the Salsich Lumber Company, at McKenna, Wash. The latter company has also ordered an 80-kw alternator driven by a Chandler-Taylor engine; a 15-kw steam-driven and a 15-kw motor-driven exciter set; a four-panel switchboard; a 20-hp induction motor for driving a centrifugal pump and two 15-hp induction motors.

RECEIVERS OF AJAX LINE MATERIAL COMPANY DISCHARGED.—Mr. Albert Scheible, president of the Ajax Line Material Company, Chicago, informs us that, having succeeded in securing the discharge of the receiver, the company has resumed business at the old stand. While at present trade conditions are not nearly ideal, the company believes that it can make steady headway and in time show every one of the friendly creditors who co-operated in re-establishing the business, that their support during the recent trying months is deeply appreciated.

THE COPPER MARKET.—Expectations of a substantial improvement in the copper situation, which seemed to be justified by the advance of the metal about a week ago Monday, were not realized, and speculative buying met with such an abundance of metal that the market speedily weakened both here and in Europe. One of the largest selling agencies reported sales at 13 cents, but buyers were scarce, and the sales at this price were all for small amounts. On Wednesday, May 20, prices advanced ⅛ of a cent, and there was considerable speculative buying. The optimists pointed to the fact that the present supplies are one-fifth of those a year ago and the stocks one-half or less, and professed to believe there was ground for permanent improvement in the situation. The pessimists, on the other hand, took the view that with 100,000,000 lb. in surplus stocks and with 100,000,000 to 125,000,000 lb. in European warehouses and with imports and a monthly production considerably in excess of the present consumption, there was no alternative except a further decline in prices. The pessimists seemed to be confirmed in their views when on Thursday there was a small price decline in London, which had the effect of unsettling conditions here. It was reported that there were urgent offerings of Japanese metal and that other foreign interests were pressing the market. Abundant supplies and continued light demand during the remainder of the week made a situation quite the reverse of the beginning of the week. The United Metals Selling Company reported sales on Monday last at 12⅞ cents a pound, and one of the largest producers asserts that the demand continues to show a moderate improvement. On account of the falling off in business and low bank rates, due to the accumulation of money, a number of consumers have invested a part of their surplus funds in increasing their copper stocks. On the first day of this week prices on all grades were reduced to the basis of 12¾c. for electrolytic and the dealers were slightly pessimistic, as there are three or more sellers, apparently, for every buyer. Exports from the port of New York since the first of the month were 16,420 tons. Monday's closing prices on the Metal Exchange were as follows:

Lake	12¾ @ 12⅞
Electrolytic	12½ @ 12¾
Castings	12⅜ @ 12½

The London market was as follows:

	Noon.			Close.		
	£	s	d	£	s	d
Standard copper, spot	56	17	0	57	0	0
Standard copper, futures	57	12	6	57	15	0
Market	Easy.			Steady.		
Sales of spot	400 tons					
Sales of futures	800 tons					

Extreme fluctuations for the year:

	Highest.			Lowest.		
Electrolytic copper, spot	13¾			12¼		
Lake copper, spot	13⅞			12⅜		
Casting copper, spot	13½			12⅛		
London, spot	£64	5	0	£56	10	0
London, futures	64	10	0	56	17	6
London, best selected	67	10	0	60	5	0

GENERAL ELECTRIC ORDERS.—The total of orders received by the General Electric Company for the first quarter of 1908 was $10,033,172, the smallest for a like period in the last four years. In 1907 the total for the quarter was $18,602,962, an increase over the $14,639,997 of 1906, which in turn was a big increase over the $12,020,715 of 1905. In 1904 the total of $9,943,279 was the lowest in the last six years for the first quarter, showing a heavy falling off from the $11,460,437 of orders received for the first quarter of 1903. Sales billed for the first quarter of 1908 amounted to $9,208,826, a big drop from the $16,035,060 in 1907, and a decrease from the $10,339,164 in 1906. In 1905 sales billed amounted to $8,672,691 for the first quarter; in 1904, $8,966,966, and in 1903, $8,245,822.

ALLIS-CHALMERS COMPANY has recently placed orders for 15,000 tons of pig-iron and over 1,000,000 lb. of copper, a pretty good indication of its faith in the immediate future and of its needs. The company is now employing at the West Allis shops in Milwaukee over 7000 men.

Financial Intelligence.

THE WEEK IN WALL STREET.—The essentially speculative character of the recent rise in securities and the unstable foundations of this advance were disclosed last week when the market tumbled headlong Tuesday, on a strong profit-taking movement, said to come from the sources which have been steadily pushing the market upward. The followers of the market quickly realized that the apex of the upward movement had been reached, for the moment at least, and quickly joined in the profit-taking, still further depressing the market. Dulness and irregularity prevailed on Wednesday, and the reactionary bull movement which started on Thursday was short-lived. During the remainder of the week the market was unsettled and depressed. There were few news developments during the week which could be used to advantage by bear operators. As a whole, the industrial situation has shown substantial improvement during the last few months and crop reports continue favorable. It became evident early in the week that there was little chance that Congress would not take any steps during this session to modify the currency laws, but this had been discounted by the Street. Gold exports to the amount of $30,000,000 have been engaged, mostly by Berlin, as that is the only foreign money center where interest rates are high enough to justify such heavy withdrawals. The government deficit for the fiscal year up to the end of May was $62,500,000, against a surplus of $65,000,000 at the same time last year, and this condition of affairs, coupled with the heavy gold withdrawals, is exciting apprehension among the bankers. Among the securities which figured prominently during the week were the Steel stocks, which were strong on the news of betterment in steel conditions; the copper stocks, including American Smelting and Amalgamated Copper, and Consolidated Gas, which was marked upward rapidly on indefinite rumors. At the opening of the market on Monday there was some further selling on stop-loss orders which carried prices somewhat below those of Saturday, but thereafter the general trend of the market was upward, with prices closing, in many instances, the highest of the day. Closing prices were as follows:

NEW YORK.

	May 18	May 25	Shares Sold.		May 18	May 25	Shares Sold.
All.-Ch.	9⅝	9¼*	3,500	Int.-Met., com.	12⅛	12¼	16,950
All-Ch., pfd.	25⅛	24	6,400	Int.-Met., pfd.	32	32⅞	22,480
Amal. Cop.	69⅜	65¼	322,700	Mackay Cos.	64½	66	1,400
Am. D. T.	39*	39*	——	Mackay Cos., pfd	66¼	65	200
Am. Loc.	51⅛	49¼	15,460	Met. St. Ry.	25	27	——
Am. Loc., pfd.	103½	103*	1,600	N. Y. & N. J. Tel.	105	105*	——
Am. Tel. & C'bl.	60	60*	——	Steel, com.	39⅛	37½	541,761
Am. T. & T.	117¾	117½	1,700	Steel, pfd.	103¼	101⅝	35,975
B. R. T.	52⅛	51	123,445	W. U. T.	55⅝	57¼	6,580
Gen. Elec.	140	133½	15	West'h, com.	53¼	51	8,374
Hud. R. Tel.	—	—	——	West'h, pfd.	70	67	602

PHILADELPHIA.

	May 18	May 25	Shares Sold.		May 18	May 25	Shares Sold.
Am. Rys.	44¼	44¼	——	Phila. Elec.	8⅜	8¼	——
Elec. Co. of Am.	9⅞	10	——	Phila. R. T.	16⅛	15¼	——
Elec. Stor. B'ty.	32	30	——	Phila. Traction.	92	—	——
E. S. B'ty, pfd.	—	—	——				

CHICAGO.

	May 18	May 25	Shares Sold.		May 18	May 25	Shares Sold.
Chicago City Ry.	160	160	——	Met. Elev., com.	17	18	——
Com. Edison	94¼	94¼	——	Met. Elev., pfd.	54	54	——
Chicago Subway	19⅞	21¾	——	National Carbon.	62⅛	63	——
Chicago Tel. Co.	122½	122	——	Nat. Carbon, pfd.	110	110	——

BOSTON.

	May 18	May 25	Shares Sold.		May 18	May 25	Shares Sold.
Am. Tel. & Tel.	118	117½	——	Mass. E. R., pfd.	43	—	——
Comb'ind Tel.	—	—	——	Mex. Tel., pfd.	—	—	——
Edison El. Ill.	214	214	——	New Eng. Tel'p.	113½	112	——
Gen. Elec.	140⅛	134½	——	W'st Tel. & Tel.	6¼	6¼	——
Mass. Elec. Ry.	10	—	——	W. T. & T., pfd.	65½	—	——

*Last price quoted.
Shares sold are for week May 18, May 25.

PHILADELPHIA ELECTRIC STOCK.—Philadelphia Electric stock, having been credited with $1 per share paid in, on account of surplus earnings which went into plant, in addition to the recent $1.25 cash assessment paid, stockholders in reality are getting a higher rate of cash dividends return than heretofore, on the actual cash paid in by them. They have paid in so far $11.25 cash on their stock, and on this amount the semi-annual dividend, just declared, amounting to 2½ per cent on the paid-in value of the stock, $12.25, is 30⅝ cents a share. This dividend of 30⅝ cents a share is a return of 5.4 per cent per annum on the $11.25 cash investment in the stock, an advance from 5 per cent, the former return. At the market price of 8¾ for Philadelphia Electric stock the dividend yield is 7 per cent.

RECEIVER FOR FAYETTEVILLE ELECTRIC COMPANY.—In the United States Circuit Court at Raleigh, N. C., Mr. H. H. Carr, general manager of the Raleigh Electric Company, was recently appointed receiver of the Fayetteville Gas & Electric Company, of Fayetteville, N. C.

WESTINGHOUSE REORGANIZATION COMMITTEES.—The report of the merchandise creditors' committee of the Westinghouse Electric & Manufacturing Company and the report of the stockholders' committee, which will be submitted to the reorganization committee on June 1, will show sufficient progress in the plans of the respective sub-committees to warrant further time for the complete realization of the plans for reorganization. As far as the merchandise creditors' committee is concerned, the success of the plan is assured. Mr. George Verity, chairman of the committee, reports that of the $4,250,000 represented by the committee, it is assured that the $4,000,000 of assenting stock which was guaranteed will be taken by the creditors in exchange for their claims, and the committee expects, before it finishes its work, to arrange to take care of $4,250,000 of assenting stock, or the entire amount represented by the merchandise creditors. The large number of stockholders and the difficulty, in many cases, of reaching them, has necessarily made the progress of the stockholders' committee much slower than the work of the merchandise creditors' committee, but the response has been steady and substantial, and with subscriptions of more than $1,000,000 the committee will be able to make a showing on June 1 which will amply justify the continuance of its efforts. "We have arranged so that a Westinghouse representative shall call upon each individual stockholder who has not as yet subscribed to the new stock," said a member of the stockholders' committee, "and that takes considerable time, as some of the stockholders are extremely hard to reach, either because they are traveling or because they live in distant places. The difficulty, also, is to convince each person that no matter how small his holdings may be, his help is absolutely necessary for the success of the plan. When we have succeeded in impressing that point of view on a stockholder we have usually had no more trouble." About 1400 of the entire 3800 stockholders have been reached to date. Following the second circular issued by Mr. Westinghouse urging upon the stockholders the necessity for co-operation, the responses increased materially, and as the time for subscriptions draws to a close it is expected that the replies will come in with a rush. The first payment of 25 per cent by the holders of the new issues of common and preferred stock was made on Monday, May 25. Many of the stockholders anticipated the payments. Another payment of 20 per cent of the amount subscribed by each stockholder will fall due on Aug. 1, 1908, 15 per cent on Jan. 1, 1909, and 15 per cent on April 1, 1909. In a recent interview in Pittsburg, Mr. J. W. Marsh, chairman of the merchandise creditors' committee, said in reference to the working out of the plan of reorganization: "All indication points to the successful completion of our plan. The progress so far has been very satisfactory, and it appears that the creditors and stockholders have at last come to a full realization that it is up to them to place the Westinghouse Electric & Manufacturing Company in the strongest possible position. Next week will tell the tale, as there is still much to be done. While there are many creditors who have signed the agreement and have sent it in to us, there are yet a few who seem to hesitate, and upon these I wish to impress the fact that they ought to do like those others have done. The same is true with the stockholders. The committee is receiving additional subscriptions every day, still it has not yet received them all. But if between now and June 1, which time we have to make good, all join in a strong pull and a pull together, the plan will be an accomplished fact. I hope that every stockholder who has not already subscribed will see the wisdom of doing so right away. The Westinghouse Electric & Manufacturing Company is one of the most important factors among the industrial plants of the Pittsburg district, and to preserve its integrity as a Pittsburg enterprise, there is, to my mind, scarcely any sacrifice too great to make." In his discussion of the matter in a general way Mr. Marsh inferred that there was the one great danger of failure through over-confidence, and the fact that because so much has been done successfully to this end that the individual creditor and stockholder would not think it incumbent upon himself to act with the others. All are needed to make the matter safe and sure.

DIVIDENDS.—The directors of the American Railways Company have declared the regular quarterly dividend of 1½ per cent, payable June 15, to stock of record May 29. The directors of the Rochester Railway & Light Company have declared the regular quarterly dividend of 1¼ per cent on the preferred stock, payable June 1 to stock of record May 15. The directors of the Norfolk Railway & Light Company have declared a regular quarterly dividend of 1½ per cent, payable June 5 to stock of record May 25. The Mackay Companies have declared the regular quarterly dividends of 1 per cent on the common and preferred stocks, payable July 1 to stock of record June 13. The directors of the Pensacola Electric Company at a meeting May 20 decided that it was inadvisable to declare the usual semi-annual dividend of 3 per cent, due June 1, 1908, on the cumulative preferred stock. The income of the company was impaired by a strike on the part of its employees, which resulted in materially increased expenses, and a loss in earnings through a boycott. The strike is now ended and expenses and earnings are returning to the normal basis.

LITTLE ROCK RAILWAY & ELECTRIC COMPANY.—The report of the Little Rock Railway & Electric Company gives an April gross of $35,559 as compared with $49,139 for the same period in 1907; expenses and taxes were $27,607, leaving an April net of $27,952, as compared with $23,530 for April, 1907. Deducting interest and sinking fund, or $9,566, left a surplus for the month of $18,386 as compared with $14,844, the surplus for April, 1907. The reserve fund of $3,000 made the net April surplus $15,386. The gross for the four months was $219,068. Expenses and taxes of $109,046 rendered a four months' net of $110,022. Deducting interest and sinking fund charges amounting to $37,066, left a surplus for the four months of $60,956 as compared with $54,755, the surplus for the corresponding four months of the previous year.

KNOXVILLE RAILWAY & LIGHT COMPANY.—The Knoxville Railway & Light Company reports gross operating earnings for April of $45,992, against $47,127 for April, 1907. Expenses and taxes are $22,640, a decrease of $2,026 from the previous year. The net for April was $23,352, a decrease of $1,109 from the net of the corresponding month of the previous year. Deducting interest and charges of $11,394 left a surplus of $11,958. The gross for the four months ended April 30 was $174,009; expenses and taxes were $95,986, making the net for the four months, $78,023. Deducting interest charges of $45,862 left a four months' net surplus of $32,161, as compared with $27,728 net surplus for the corresponding months in 1907.

THE PENSACOLA ELECTRIC COMPANY has passed the semi-annual dividend of 3 per cent on the 3000 6 per cent cumulative preferred shares, due for payment June 1. Stone & Webster, the general managers, state that the income was impaired by a strike and boycott, which are now ended, and with the restoration of normal conditions it is hoped that dividends will soon be made up. The trouble was purely of a temporary nature and the territory that the company serves is prosperous, though adversely affected by the business depression. Better discipline will result now that the menace of constant labor troubles has been removed.

TELLURIDE POWER COMPANY FILES $10,000,000 MORTGAGE.—The Telluride Power Company, of Salt Lake City, has filed a mortgage of $10,000,000 to the Citizens' Savings & Trust Company, of Cleveland, covering an issue of 6 per cent 30-year gold bonds, secured by rights, plants and franchises in Colorado, Utah and Idaho. Of the $10,000,000, $2,500,000 will be used to take up floating indebtedness, and the remainder for further indebtedness. The company has an extensive system of power plants and power transmission lines in the three States mentioned.

MICHIGAN STATE TELEPHONE.—The report of the Michigan State Telephone Company for the quarter ended March 31, 1908, showed gross earnings of $804,021 against $726,724 for the same period last year. Expenses, taxes, etc., were $600,714, making the net for the quarter of $203,307, as compared with $259,659 for the same period in 1907. Deducting interest charges of $104,463 and preferred dividends of $34,248, left a surplus of $64,596, which is at the rate of 7.3 per cent per year on the $3,500,000 common stock. The net gain in telephones in March was 653 and in April 628.

AMERICAN TELEPHONE BONDS AND MASSACHUSETTS BANKS.—The Massachusetts Senate is considering an amendment to the Savings Bank Bill which would authorize the Massachusetts Savings Banks to invest in the $53,000,000 American Telephone 4 per cent collateral trust bonds, due 1929.

ENGLISH MARCONI COMPANY INCREASES STOCK.—At a special meeting of the Marconi Wireless Telegraph Company in London last week, it was voted to increase the capital stock to £750,000 by creating 250,000 preferred shares.

NORFOLK & PORTSMOUTH TRACTION COMPANY.—The annual report of the Norfolk & Portsmouth Traction Company and allied companies for the year ended Dec. 31, 1907, shows gross earnings of $2,616,458, an increase of $896,912 over 1906. Operating expenses were $1,655,654, an increase of $541,771 over the preceding year. Net earnings were $960,803, as compared with net earnings for 1906 of $605,663, an increase of $355,140. The total income was $958,520 and interest and taxes $704,808, making a balance of $253,712, an increase over the balance for 1906 of $149,436. Extraordinary expenses of $126,507 were reported, thus giving a surplus of $127,204, an increase of $34,960 over the surplus of the previous year. President Williams said in part in the report: "Financial conditions have been such that it has been impossible for the company to sell upon advantageous terms sufficient bonds to take care of its construction expenditures. Arrangements have been completed for notes of two, three and four-year maturities, secured by collateral. A large proportion of the floating debt of the company has been liquidated through the sale of these notes since the close of the fiscal year, Dec. 31, 1907. Notwithstanding the difficulties attendant upon the operation of the properties during the period of reconstruction, and the disappointment in attendance on the Jamestown Exposition, the results of the operations of the properties owned and controlled by your company during the year 1907 were, upon the whole, satisfactory."

TO AID WESTINGHOUSE STOCKHOLDERS.—Stockholders of the Westinghouse Electric Company who are unable to subscribe to their pro rata share of the new "assenting" stock may be cared for by the banking firm of Dominick & Dominick, of 115 Broadway, which agrees to purchase the necessary shares for any stockholders and give the stockholder one year from July 1, 1908, in which to take up the stock. The firm agrees to take up and pay for 25 per cent of the new stock to which a stockholder is entitled to subscribe, the latter to deposit his old stock as security for the loan, in addition to paying 6 per cent interest from July 1, 1908, and $1 commission on each share purchased. Any stockholder not taking up his stock by July 1, 1909, will be sold out. A member of the firm stated that this offer was not made in the expectation of considerable profit, but at the request of the Westinghouse Company. Under the reorganization plan, the stockholders must subscribe to $6,000,000 of the new stock at par. If they fail to do this the property will be sold for the benefit of the creditors; but if the plan is put through, which seems extremely likely, it is expected that the stock, which is now selling in the neighborhood of 50, will advance 30 or 40 points.

SEATTLE ELECTRICAL BONDS.—A syndicate composed of Lee, Higginson & Company, N. W. Harris & Company and Estabrook & Company, has purchased $2,500,000 of Seattle Electric Company consolidated and refunding, mortgage, sinking-fund 5 per cent bonds, due Aug. 1, 1929. The same syndicate bought $2,500,000 of these bonds last July, which were quickly placed among investors. This new issue will provide funds to pay off the existing floating debt of the company incurred in property extensions and will leave a substantial balance to be added to working capital. The Seattle Electric Company represents a capital investment of more than $140,000,000 and controls practically all of the street railway mileage, electric lighting and power business in that city, which has, it is stated, increased in population from 80,671 in 1900 to 240,000 at the present time.

MANHATTAN RAILWAY BOND ISSUE.—The Public Service Commission of the First District, New York, received last week an application from the Manhattan Railway Company for permission to issue $10,818,000 in bonds to refund the first mortgage bonds of the Metropolitan Elevated Railway Company, which become due on July 1. Permission was also asked to issue $894,000 in bonds for the purpose of repaying the company for the cost of extending the lines in the Bronx from Tremont Avenue to Bronx Park. With the petition there was filed a statement which showed that the gross earnings of the company for the year ended March 31, 1908, were $14,254,322, other income $462,173, operating expenses $6,182,366 and gross income from operation $8,534,129. May 22 was the date set by the Commission for the first hearing on the application.

AMERICAN TELEPHONE & TELEGRAPH COMPANY.—The report of the American Telephone & Telegraph Company for April shows total earnings of $3,642,424, an increase over April, 1907, of $578,060; expenses of $192,925, an increase over 1906 of $6,008. Net earnings for April were $3,449,499, an increase of $572,052, and the surplus $2,801,445, an increase over the surplus of April, 1907, of $528,113. The total earnings for the first quarter, from January 1 to April 30, were $10,755,823, against $9,076,324 for the first quarter of 1907, an increase of $1,679,499. Expenses were $719,112, leaving net earnings of $10,036,711, an increase over the net for the same time the previous year of $1,639,512. Deducting interest and dividends, the net surplus is $4,409,516, an increase over the net surplus for the same time in 1907 of $944,036.

MONTREAL STREET RAILWAY.—The report of the Montreal Street Railway for the month of April shows gross earnings of $280,736 and expenses of $170,141, leaving an April net of $110,595 against a net for April, 1907, of $108,213. The April surplus for 1908 was $59,250 against a surplus for the same month in the previous year of $62,896. The gross for seven months ended April 30 was $2,027,872, an increase over $1,873,683, the gross for the corresponding months in 1907; expenses were $1,316,007 against $1,240,079, leaving a seven months' net of $711,865 as compared with $633,604, the net for the corresponding seven months in 1907. The report gives a surplus for the seven months of $387,878, an increase over last year's surplus for the same period, which was $349,408.

KEYSTONE TELEPHONE REPORT FOR APRIL.—The April report of the Keystone Telephone Company gives gross earnings of $87,807, an increase of $398 over the gross April earnings for 1907. Expenses were $41,719, a decrease of $810 from the expenses for the same period in the previous year, and the April net was $46,088, an increase of $1,208 over the period in comparison. The gross for ten months ended with April, 1908, was $875,785 against $819,890 for the corresponding ten months in 1907, an increase of $55,895, expenses $455,856, an increase of $22,462 over the period in comparison, and the ten months' net $419,929 against a net of $386,496 for the same time in the preceding year, an increase of $33,433.

NORTHERN OHIO TRACTION.—The report of the Northern Ohio Traction Company for the month of April showed gross earnings of $129,804. Expenses were $82,252, leaving an April net of $47,552 as compared with a net for April, 1907, of $49,955. Charges were $44,029, and the April surplus $3,523 against an April surplus in 1907 of $7,553. The gross earnings for the four months ended April 30 were $505,889, expenses $324,883, and a net for the four months of $181,006. Deducting charges of $172,889 left a surplus for the four months of $8,117, a decrease from the surplus of 1907 of $23,889; 1906 showed a deficit of $10,385.

UNITED RAILWAYS OF ST. LOUIS.—The report of the United Railways of St. Louis for April shows gross earnings of $865,691, a decrease of $19,232 from April, 1907. Expenses of $570,663, a decrease of $12,376 for the same time last year, and a net for April of $295,028, a decrease of $6,856 from April, 1907. Charges were $232,274, making a surplus for April of $62,754, a decrease from the April surplus of 1907 of $8,238. The four months' net was $1,123,744, an increase of $50,304 over the first quarter of 1907. The four months' surplus of $191,308 was an increase of $42,494 over the first quarter of the preceding year.

PACIFIC LIGHT & POWER COMPANY.—The report of the Pacific Light & Power Company, of Los Angeles, for the year ended Dec. 31, 1907, shows gross earnings of $1,281,055 against $1,332,534 in 1906, a decrease of $51,479. Reduced operating expenses and expenditures enable the company, in spite of the decreased gross earnings, to show a net of $749,239 against $699,093 for 1906, an increase of $50,146.

CUMBERLAND TELEPHONE & TELEGRAPH.—The April report of the Cumberland Telephone & Telegraph Company shows gross earnings of $511,378, an increase of $25,229 over April, 1907, and a net of $206,845, an increase of $16,760 over the corresponding month last year. The surplus, after deducting charges, was $169,264, an increase of $17,492 in the two periods under comparison.

AMERICAN LIGHT & TRACTION STOCKHOLDERS.—The number of the stockholders of the American Light & Traction Company has doubled in the last four years, the number now being 1800. The greater part of the increase has been since the panic in October, when the company's stock sold way down. Since that time about 175 new stockholders have been listed.

GENERAL NEWS

Late items are printed unclassified at end of department

Construction News.

FORT SMITH, ARK.—The Pan Telephone Company contemplates making improvements to its system which will involve an expenditure of about $300,000.

OSCEOLA, ARK.—Plans are being made to erect a copper toll line from Osceola to Festus, Mo., a distance of 180 miles, by the Southeast Missouri Telephone Company, the Tri-State Telephone & Telegraph Company and the Cape Girardeau Telephone Company, the cost of which is estimated at $30,000. The lines will be erected on poles already placed.

ROGERS, ARK.—The city is considering the question of purchasing the electric light plant and water works system. E. W. Homan is mayor.

ALAMEDA, CAL.—The Municipal Electricity Commission has awarded the contract for a new boiler for the electric light plant to the Risdon Iron Works for $5,100. The commission also contemplates installing a heating and water plant to warm the water used by the turbine engine.

CHICO, CAL.—An electric power plant has been installed in the mines of the Steifer Mining Company, near Magalia, at a cost of $20,000.

DOWNIEVILLE, CAL.—The Sierra Mercantile Mining & Power Company is planning to construct a hydro-electric power plant at Downieville. Richard Phelan is general manager.

LOS ANGELES, CAL.—The Elysian Park Improvement Association is considering the question of obtaining gas and electric service for the Elysian Park District.

LOS ANGELES, CAL.—Announcement has been made that work will commence immediately on the conversion of the Southern Pacific Railroad Company's line from this city to Santa Monica into a double-track electric railway as part of the Los Angeles-Pacific Railway system.

OAKLAND, CAL.—The directors of the San Francisco, Oakland & San Jose Consolidated Railway Company have authorized a bond issue of $7,500,000, of which the proceeds of $3,000,000 will be used for additions and improvements to the property. The company contemplates the construction of a railway to the proposed capitol site in North Berkeley and also a line through the county to Hayward, and from there to San Jose. E. A. Heron is president of the company.

OROVILLE, CAL.—It is reported that the Pacific Electric & Gas Company is contemplating the construction of another power plant at Bucks Valley. The company is endeavoring to purchase several hundred acres of land in Bucks Valley, about 45 miles from this city, to be used as a reservoir site, where it is said that between 45,000 and 50,000 hp can be developed.

PALO CEDRO, CAL.—The Northern California Power Company has commenced work on the construction of a 60,000-volt transmission line from its substation at this place to Kennett, where a substation will be constructed, with an output of 7000 hp. The company will furnish electrical energy for operating the Mammoth Mine and smelter at Kennett and will also furnish electricity for the electric process iron smelter at Heroult. The transmission line will be 16 miles in length and will transmit 20,000 hp.

SACRAMENTO, CAL.—Judge J. B. Devine, representing W. T. Tarrett and other capitalists, of San Francisco, has applied to the Board of Supervisors for a franchise for a street railway in and about Oak Park, Gould and Carleton. The proposed railway will be about six miles in length.

SAN DIEGO, CAL.—Bids will be received at the office of the constructing quartermaster, Fort Rosecrans, Cal., until June 2 for constructing electric wiring and fixtures, heating, etc., for post exchange and gymnasium building at Fort Rosecrans. Information furnished on application. Plans and specifications can be seen at the office of the quartermaster at Fort Rosecrans and at the office of the chief quartermaster, Chronicle Building, San Francisco. Lieut. Earl McFarland is quartermaster.

SAN FRANCISCO, CAL.—The Southern Pacific Company has applied to the Board of Public Works for permission to erect a hospital and power-house in the block bounded by Baker, Lyons, Hayes and Fell Streets. The power-house will furnish heat and light for the hospital. The cost of the entire work is estimated at $265,000.

SAN FRANCISCO, CAL.—A comprehensive plan for lighting the new retail district of the downtown section of the city has been submitted to the Board of Supervisors by the Permanent Downtown Association, an organization composed of merchants, property owners and other business men in the district bounded by Sutter, Powell and Market Streets. The scheme contemplates 160 poles, averaging about eight poles to a block and three to the short blocks. The supervisors have accepted the plan; it now remains for them to furnish electricity for the lamps, and when arrangements have been made the poles will be erected free to the city.

SAN JOSE, CAL.—The Tuolumne Water Power Company has applied to the Board of Supervisors of Santa Clara County for a franchise to erect transmission lines and conduits for the transmission of electricity on the roads and public highways in Santa Clara County for a period of 50 years. The franchise will be awarded to the highest bidder, for which bids will be received until June 15.

SANTA ROSA, CAL.—The contract has been awarded for the construction of the transmission line from the generating plant of the Snow Mountain Power & Water Company on Eel River, Mendocino County, through Hopland, Cloverdale, Healdsburg, Windsor, Santa Rosa and Petaluma.

SONORA, CAL.—S. L. Stovall has filed notice of appropriation of 10,000 cu. in. of water from the middle fork of the Tuolumne River, which will be developed to generate electricity.

SONORA, CAL.—G. F. Wakefield, of San José, has filed a notice of appropriation of 45,000 miner's inches of water on the Middle Fork of the Tuolumne River; also all public lands to be flooded, the water to be conveyed to Moccasin Creek Mouth, where it will be used for the generation of electricity and for irrigation purposes in Tuolumne and other counties.

COLORADO SPRINGS, COL.—Plans are being made by the Manitou & Crystal Park Railroad Company to commence the construction of its railroad, which will involve an expenditure of about $500,000. J. K. Vanatta is president of the company.

COLORADO SPRINGS, COL.—The Colorado Springs Electric Company has decided to make extensive improvements to its plant on West Cucharas Street. Work will commence at once, and it is expected to have it completed before fall. The output of the plant will be increased to 1500 kw. The cost of the improvements is estimated at $100,000. As soon as the litigation with the Empire Power & Water Company is settled the Colorado Springs Electric Company will begin work on its power plant in Ute Pass. The company have already secured reservoir sites, but nothing further has been done.

LYONS, COL.—The Rocky Mountain Hydro-Electric Company contemplates the construction of a power plant on North Street, Vraim Creek, eight miles from Lyons, where it will develop 4250 hp, which will be transmitted to Denver, a distance of 42 miles. The cost of the plant is estimated at $370,000. L. H. Dieterich, of Lyons, is resident engineer, and R. M. Jones, 1142 Humboldt Street, Denver, is chief engineer.

HARTFORD, CONN.—Bradley & Hubbard, of Meriden, have secured the contract for furnishing electrical fixtures for the State Arsenal.

MIDDLETOWN, CONN.—The Middletown Electric Light Company has decided to postpone the erection of its new plant until next year.

WILMINGTON, DEL.—The West Chester & Wilmington Electric Railway Company has been granted a franchise to build an electric railway from the northwestern city limits to Washington, where it will connect with the People's Railway.

WHITE SPRINGS, FLA.—Surveys are being made by D. G. Zeigler & Company, of Atlanta, Ga., for the development of water power, located about three miles from White Springs. It is said that about 23,000 hp can be developed.

ABBEVILLE, GA.—The citizens have voted to issue $12,000 in bonds for the construction of a municipal electric light plant. P. A. McDaniel is mayor.

ATLANTA, GA.—A trust deed conveying all franchises to build and operate a railroad on the streets of Atlanta through College Park, Monroe and other cities to Augusta to the Chicago Title & Trust Company and W. C. Niblack has been filed by the Atlanta & Carolina Railroad to secure the issuance of $6,000,000 in bonds. James W. English is president of the railroad company.

JACKSON, GA.—The Central Georgia Power Company, of Macon, has awarded the contract for the construction of its dam, power house, etc., for its hydro-electric plant near Jackson to Lane Brothers, of Richmond, Va. Changes made in the size of the power house and equipment will increase the cost of the plant to $2,500,000. J. G. White & Company, of New York, N. Y., are the engineers.

LAGRANGE, GA.—Plans are being considered to improve the municipal electric light plant, which will involve an expenditure of from $12,000 to $15,000. J. D. Edmundson is Mayor.

MACON, GA.—The Flint River Power & Electric Company has petitioned the State Railroad Commission for permission to issue $10,000,000 in bonds and $12,000,000 in stock, the proceeds to be used in connection with the development of water powers on Flint River. This company is a subsidiary of the Central Georgia Power Company, of Macon, which was recently granted permission to develop water powers on the Oconee and Ocmulgee Rivers. The committee is reported to have decided to recommend favorable action on part of the commission.

SAVANNAH, GA.—During the past year the Savannah Lighting Company has made extensive additions to its power plant, which include the installation of a 350-hp Babcock & Wilcox boiler with superheater and economizer; one 500-kw, 2200-volt, two-phase Allis-Chalmers-Bullock turbo-generator set, with complete equipment of condensing apparatus manufactured by the Wheeler Condenser Company. The company is now installing an additional 500-kw unit of the same output with auxiliaries,

including condenser, circulating pumps, etc., and nine additional panels for switchboard at the power house. The substation has been remodeled and nine additional panels added to the switchboard to take care of the distribution of about 20 miles of overhead transmission lines through the residence portion of the city. H. L. Wills is manager.

COEUR D'ALENE, IDAHO.—A number of prominent mine owners of Coeur d'Alene contemplate the construction of a power plant to furnish electrical energy for the mines in this section. It is said that H. M. Lancaster has taken an option on a site at Slate Creek where 25,000 hp can be developed.

MINIDOKA, IDAHO.—Bids will be received at the office of the U. S. Reclamation Service, Federal Building, Chicago, Ill., until June 19 for furnishing electrical apparatus for use in connection with the power and pumping development at Minidoka dam, Minidoka Irrigation Project. The cost of the material to be covered by immediate purchase is estimated at $55,000, and that of the optional material about $100,000. Further information may be obtained at the Chicago or Washington offices, or of O. H. Ensign, 25 Carroll Block, Madison, Wis., chief electrical engineer.

BLOOMINGTON, ILL.—It is reported that the plant of the Union Gas & Electric Company has been purchased by an Elmira syndicate headed by Edwin Witherby. The price paid for the plant is reported to be $400,000.

CHICAGO, ILL.—The City Council has entered into a contract with the Sanitary District Board to purchase electricity for the municipal electric lighting system at the rate of $15 per horse-power per year. It is said that the steam generating plants will be converted into distributing stations. The new arrangement will enable the city to light the streets of the city at a great reduction in cost.

HILLSBORO, ILL.—The Mississippi Valley Interurban Railway Company is preparing to extend its railway system in Bond, Christian, Montgomery and Sangamon Counties. John E. Melick, of Springfield, is president of the company. B. F. Bond is superintendent of construction, with headquarters in Hillsboro.

JACKSONVILLE, ILL.—Plans are being prepared for a new electric light plant for the city to cost $20,000. C. W. Brown is consulting engineer.

LIBERTYVILLE, ILL.—Plans are being prepared for the North Shore Electric Company for the construction of a substation at Lake Bluff. The power plant will be located on the road to Libertyville.

CHANDLER, IND.—The Home Telephone Company has applied for a franchise to extend its lines to and through Boone.

GEORGETOWN, IND.—An independent telephone company has been organized by the residents of Georgetown and the farmers of the surrounding country to construct a telephone system to connect with the exchange at Crandall.

RICHMOND, IND.—The Richmond Light, Heat & Power Company contemplates extensive improvements to its plant at a cost estimated at $60,000. E. E. Witherby is general manager.

BELLEVUE, IA.—The Council is considering the question of erecting a dam on the creek to furnish power to operate the municipal electric light plant.

CLINTON, IA.—The question of establishing a municipal electric light and ice plant in this town is under consideration, and a committee has been appointed to obtain information and estimates of the cost of the same. For further information address I. L. Herman.

COLFAX, IA.—James Donahue, of Davenport, has been granted a franchise to build an electric car line from this city to the Hotel Colfax, a distance of one mile, and has also secured the right of way.

ELDORA, IA.—Work has commenced on the final surveys of the Iowa Railroad Company, which proposes to construct an electric railway 127 miles in length, which will connect Waterloo, Cedar Falls and Des Moines and intervening cities. The power plant will be located at Eldora. The company also plans to furnish electricity for lamps to towns along the route of the railway. Andrew Stevenson, of Chicago, Ill., is president.

MASON CITY, IA.—The Western Electric Telephone Company has purchased the property and holdings of the Northern Telephone Company for $15,000. The company is planning extensions to its system, which will involve an expenditure of over $200,000.

SIOUX CITY, IA.—All bids opened by E. E. Homer May 11 for the construction of pumping and power plant, including machinery, also for repairs on hospital building and for electric wiring of various buildings at the County Poor Farm have been rejected.

ATCHISON, KAN.—The contract for the installation of the ventilating, heating and power plant for the high school has been awarded to Lewis Kitchen, Kansas City, Mo.

BALDWIN, KAN.—The City Council has granted a franchise to Rawlings & Company, of Chanute, for a railway system through Baldwin. The line will run from Coffeyville, through Independence, Chanute and other cities to Baldwin. Later a railway will be built from Baldwin to Lawrence.

CONCORDIA, KAN.—The city has entered into a contract with the Concordia Electric Light Company to furnish electricity to operate the pumping station at the water works.

STOCKTON, KAN.—The City Council is contemplating the purchase of the local electric light plant. If the plant is purchased improvements will be necessary.

TOPEKA, KAN.—The Board of Trustees has decided to install an entire new steam plant in the municipal electric light plant. The present plans provide for an entire new set of boilers, a water purifier, a steel stack about 100 ft. high, with rearrangement of some of the pole lines. New lamps will be purchased. The plant will be built to provide for 500 lamps. As yet it has not been decided whether new generators will be purchased. The cost of improvements is estimated at about $35,000.

JACKSON, KY.—The local electric light plant has been reorganized under the name of the Jackson Electric & Hydraulic Company. It is said that the company proposes to construct an ice plant in connection with the electric light plant.

AMITE CITY, LA.—The City Council on May 13 voted to sign a contract with the Central Light & Power Company pledging $100 per month for street lamps. Work has commenced on the rebuilding of the plant.

FRANKLINTON, LA.—W. A. Erwin is considering the question of installing an electric light and ice plant in Franklinton.

LAUREL, MD.—An election will soon be held to vote on the proposition of issuing $15,000 in bonds to improve the municipal electric light plant.

ADAMS, MASS.—The Adams Electric Light Company is making arrangements to extend its transmission lines to the plant of the Universal Carbon Trust Company, which will operate its plant by electricity.

CLINTON, MASS.—Plans are being prepared for the construction of a new power plant for the Bigelow Carpet Company, which the company proposes to construct in the rear of its new mill on Union Street. The new plant will furnish power to operate both the new and the old mills. Charles T. Main, of Boston is the architect.

CLINTON, MASS.—The Legislative committee on ways and means has reported to the House a recommendation for the appropriation by the State of $115,000 for the purchase and installation of machinery for the development of electrical power at the Wachusett dam and a further appropriation of $7,000 for the necessary changes and additional work at the power house.

MARION, MASS.—The Marion Gas Company has decided to introduce electric service in connection with its gas business. The capital stock of the company will be increased and further arrangements made later.

SHELBURNE FALLS, MASS.—Wilcox & Halligan, proprietors of the local electric light plant, have applied for permission to incorporate. It is proposed to erect a larger plant and to supply electricity for motors as well as lamps.

SHREWSBURY, MASS.—The citizens on May 13 voted to construct and maintain a plant for the distribution of electricity for lamps and motors in this town to cost not more than $16,000. It is proposed to purchase electrical energy to operate the system. The committee favors a five-year contract with the Marlboro Electric Light Company. The street lighting committee was authorized to construct the plant and if necessary sign contracts for a term of ten years for electrical energy for the system. The lighting system will consist of 175 tungsten lamps of 30 cp.

WEST MEDWAY, MASS.—The citizens have voted to appropriate $2,700 for lighting the streets by electricity.

CEDAR SPRINGS, MICH.—Application for a franchise to furnish electricity in this city has been made to the Common Council by Burlingame, Bender & Company, of Grand Rapids. The company proposes to construct a power plant at Morley and offers to furnish energy for arc lamps at the rate of $60 per lamp per year and for incandescent lamps at 10 cents per kw-hour.

GRAND RAPIDS, MICH.—The Canal Street Improvement Association has awarded the contract for the erection of 17 steel arches to the Grand Rapids Electric Company and the Grand Rapids-Muskegon Power Company will furnish electrical energy for the lamps.

HOXEYVILLE, MICH.—An independent telephone company has been organized by the residents of this city to install a local system.

JACKSON, MICH.—The Commonwealth Power Company will spend $50,000 in repairing the dam at Plainwell, which was washed out by a storm in the spring.

LUDINGTON, MICH.—The Stearns Power & Lighting Company has placed an order for electrical equipment which will double the capacity of its plant here. A new 1,000-hp Corliss engine and generator of equal capacity will be added to the plant and other improvements will be made. The transmission line will be extended to Scottville.

PELICAN RAPIDS, MICH.—The Pelican Telephone Company will soon commence the construction of a telephone line between this city, Lida and Maplewood.

PONTIAC, MICH.—The Interstate Long Distance Telephone Company has been granted a 30-year franchise to construct and operate a telephone system in this city.

BIRD ISLAND, MINN.—A telephone company has been organized by the business men of this city to build a local system. The company is planning to install exchanges in this city and Olivia, and may extend its system to Renville and a number of neighboring towns.

FERGUS FALLS, MINN.—The Union Engineering & Construction Company, of Chicago, Ill., has been awarded the contract for completing the concrete dam and power house for the municipal electric light plant. The company submitted the only bid, in which it offered to complete the

work, minus the machinery, for $40,000 and to allow the city $2,000 for the present power house and machinery, making a net bid of $38,000.

ST. CLOUD, MINN.—The Public Service Company contemplates the construction of a new power house which will have an output of 1600 hp.

WATKINS, MINN.—The system of the Watkins Telephone Company at St. Nicholas is being overhauled, and a number of new lines are to be erected.

JEFFERSON BARRACKS, MO.—Bids will be received by Captain O. W. Bell, constructing quartermaster, U. S. A., until June 15 for the construction of a complete electric lighting system, including wiring all buildings, constructing pole lines, generating station buildings, steel stack, furnishing electric fixtures, transformers and apparatus; furnishing and installing boilers, engines, elevator, pumps and generators. Also the alternate proposal to furnish electricity for lamps will be received.

SPRINGFIELD, MO.—The Springfield Traction Company has decided to extend its Elm Street line for a considerable distance.

BILLINGS, MONT.—It is reported that by a deal recently concluded between the Yegen Brothers and a representative of the Madison River Power Company the electric power plant of the former changes hands for a consideration of $200,000. It is announced that the Madison River Power Company has secured options on all the electrical power plants east of Billings, including those at Columbia Falls, Forsythe, Big Timber and Livingston, and will, if the negotiations are concluded, run a transmission line from the Dakota line to this point from one central station. It is said that the company is also negotiating for options on power plants west of Butte which would give it control of the entire State excepting Butte, Helena and Great Falls.

SOUTH OMAHA, NEB.—The Independent Telephone Company has been granted a franchise in this city to erect a telephone system and proposes to install a plant at a cost of about $200,000 and will give this city connection with Omaha and other cities in Nebraska.

ELKO, NEV.—An independent telephone company has been formed to build a telephone line between this city and Mountain Home, and later may extend the line from Mountain Home to Boise, Idaho. F. A. Sowell and others are interested in the enterprise.

GOLDFIELD, NEV.—An electric pump has been installed at the foot of the 500-ft. incline on the Kewanas.

RENO, NEV.—Bids will be received until June 1 by the Board of Aged and Indigent Insane for the construction of a power house and a wooden stave pipe line, about 45 ft. in length. F. L. Wildes is secretary of the board.

RENO, NEV.—The Truckee River General Electric Company will have its transmission line extended to the Rawhide mining camp soon. The main line will be tapped on the Douglass Ranch and the energy will be reduced at a point near the site for the new Selby mill. The lamps will be installed at once on the completion of the line.

MANCHESTER, N. H.—The Board of Mayor and Aldermen has adopted a resolution authorizing Mayor Reed and Alderman Geisel, chairman of the street lighting committee, to enter into a contract with the Manchester Traction, Light & Power Company for a term of five years. The contract calls for not less than 584 lamps at $90 per lamp per year.

NEWPORT, N. H.—The Newport Electric Light Company is making arrangements to install additional equipment in its power plant. Myron W. Tenney is treasurer and manager.

IRVINGTON, N. J.—The Public Service Commissioners are considering the question of establishing a municipal electric light plant. Eugene Turton is city attorney.

TRENTON, N. J.—Plans are being considered by the New Jersey & Pennsylvania Traction Company for extensive improvements to its system, which will involve an expenditure of about $160,000. It is proposed to enlarge the power house at Yardley to furnish additional energy required for the system.

BINGHAMTON, N. Y.—The Binghamton Light, Heat & Power Company is planning to furnish electricity to the manufacturing plants in Binghamton, Lestershire and Endicott. Plans are being made to extend its high-tension transmission line through the manufacturing district, and also to extend it down the valley to Lestershire and Endicott. Contracts have already been placed with the Globe Store for its new elevator service, the Osgood Scale Works and the Jones Scale Works.

BROOKLYN, N. Y.—The East River Terminal Railroad Company has filed an application with the Public Service Commission for a certificate of public convenience and necessity to construct and operate a railway on a number of streets in the Borough of Brooklyn. The company proposes to do a freight business exclusively.

BROOKLYN, N. Y.—Contracts have been awarded by C. B. J. Snyder, superintendent school buildings, for installing electric equipment for schools in Borough of Brooklyn as follows: To the Commercial Construction Company, of New York City, for School 128, at $9,952, and School 75 for $8,224, and to Cowden & De Young, 237 Broadway, New York City, for School 156 at $16,140.

BUFFALO, N. Y.—The Appellate Division of the Supreme Court has decided against the New York Central Railroad and its objections to the proposed Buffalo, Genesee & Rochester Electric Railway and permits the road to be built.

BUFFALO, N. Y.—Governor Hughes has signed the Hill-O'Brian bond bill, which authorizes the city to issue $50,000 in bonds, the proceeds to be used to place the wires of the Police and Fire Departments in underground conduits.

GLOVERSVILLE, N. Y.—Governor Hughes has signed Assemblyman Mill's bill extending the powers of the Board of Water Commissioners of this city so as to allow it to construct reservoirs and other works necessary to the water system of Gloversville, including the erection of a transmission line to supply electrical energy to operate the water gates and other apparatus connected with the system.

NEW YORK, N. Y.—Bids will be received until June 1 by C. B. J. Snyder, superintendent of school buildings, for installing electric equipment in alterations and additions to School 90, Borough of Manhattan.

NEW YORK, N. Y.—The permission granted to the receivers of the New York City Railway Company by Judge Lacombe, of the United States Circuit Court, to issue receivers' certificates to the amount of $3,500,000 for the purpose of rehabilitating the property was affirmed May 20 in a decision handed down by the United States Circuit Court of Appeals.

NEW YORK, N. Y.—Judge Lacombe, of the United States circuit court, has granted the petition of Frederick W. Whitridge, receiver of the Third Avenue Railroad Company, the Dry Dock, East Broadway & Battery Railroad Company and the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company for permission to issue $2,500,000 of receivers' certificates, to be used for rehabilitation of the roads. As receiver of the Union Railway Company, Mr. Whitridge may also issue $750,000 of like certificates. Provision is made for an expenditure of $3,706,000 in improving and extending the systems, the outlay to be paid out of the proceeds of the certificates and the earnings of the various lines. Of this amount $1,500,000 is to purchase new cars; $750,000 for the construction and equipment of two new power stations and a new car barn; $250,000 is to be set aside for the construction and equipment of an extension of a surface line along Pelham Parkway from Fordham station to the Bronx Zoological Park.

NIAGARA FALLS, N. Y.—The Niagara Falls Lighting Company contemplates issuing bonds, the proceeds of which will be used to construct a power plant.

PLATTSBURG, N. Y.—The Home Telephone Company is planning to place its wires in conduits in the principal streets in the city.

PLATTSBURG, N. Y.—A franchise has been granted to the Mountain Home Telephone Company to erect a telephone line through this city to Saranac Lake and surrounding country.

ROCHESTER, N. Y.—The Public Service Commission of the second district has granted the Rochester-Corning-Elmira Traction Company permission to issue bonds to the amount of $4,210,000 and capital stock to the amount of $3,880,000. The company applied for permission to issue $8,000,000 in bonds.

CHARLOTTE, N. C.—The plant of the Patterson Manufacturing Company at China Grove will soon be operated by electricity, which will be furnished by the Southern Power Company, of this city. The Patterson Manufacturing Company is also erecting a large plant at Kannapolis.

BUCYRUS, OHIO.—F. H. Froehlich, of Toledo, consulting engineer, has been engaged by the city to take charge of matters pertaining to the establishment of a municipal electric light plant. The city has two plans under consideration—one the construction of a plant to be owned by the municipality and the other involving the sale of a franchise to a private corporation. Mr. Froehlich has prepared the plans for the proposed municipal electric light plant and in case the plant is to be built will have charge of the construction.

CHILLICOTHE, OHIO.—The water power of Paint Creek will be utilized to generate electricity which will be transmitted to Cincinnati, Springfield, Dayton, Columbus, Chillicothe and other cities within a radius of 175 miles. The main power plant and distributing point will be located at Alum Cliffs, where a 90-ft. dam is to be constructed.

CINCINNATI, OHIO.—Plans are being prepared by Bausmith & Drainie, architects, Johnson Building, for a power house to be constructed on Sixth Street west of Main Street.

DAYTON, OHIO.—Permission has been granted to the Dayton City Railway Company to construct tracks on Lehman Street. The company will also construct a line from Southeast Dayton to Northwest Dayton.

LOGAN, OHIO.—The Village Council is considering the question of building a municipal electric light plant. D. V. Thurness is mayor.

MARION, OHIO.—It is reported that the citizens of Marion have raised sufficient funds to construct an electric railway between this city and Upper Sandusky. It is said that work will commence on the construction of the road within a short time.

SNYDER, OKLA.—An electric light plant, to cost $100,000, is to be erected in Snyder.

WEATHERFORD, OKLA.—The City Council has been petitioned to call an election for the purpose of voting on the proposition to issue $20,000 in bonds with which to extend the water system and construct a municipal electric light plant.

PORTLAND, ORE.—The City Council has granted a 25-year franchise for an interurban railway from Portland to Hillsboro via Mount Calvary Cemetery. H. Wittenberg is interested in the enterprise.

FRANKLIN, PA.—It is reported that the plant of the Franklin Electric Light Company has been purchased by Frank Custer, of Franklin.

HAMBURG, PA.—The Hamburg Electric Light Company on May 1 took over the plant of the Hamburg Electric Light, Heat & Power Company and will make additions to the plant to provide for a power service. The company is now installing a 60-kw, 220-volt, direct-current generator, erecting additional lines for power service, and will be in the market for an engine and boiler. The arc lighting system will be changed from open to enclosed arc lamps. The officers of the company are: H. L. Houck, of Scranton, president; W. L. Houck, of Scranton, secretary and treasurer; W. M. Bell, of Conshohocken, general manager, and Frank H. Curtis, local manager.

HARRISBURG, PA.—The Mt. Holly & Gettysburg Street Railway Company has been chartered, with a capital stock of $18,000, to build an electric railway three miles in length from Mt. Holly Park to Hunters Run and State Belt Railroad. The new road will practically be an extension of the Carlisle & Mt. Holly Electric Railway. It is expected that the road will be extended to Gettysburg. The directors are: T. M. Nelson, of Chambersburg; A. H. Nelson, W. M. Alexander, C. H. Mullin, William McGowan, W. T. Pascoe and Frank A. Birmingham.

LANCASTER, PA.—The Lancaster & York Furnace Street Railway Company contemplates extending its lines from Millersville to this city, a distance of six miles.

MAUCH CHUNK, PA.—The plant and holdings of the Carbon Street Railway Company were sold at auction to A. S. Keck, of Allentown, L. Lentz and J. M. Driesbach, of Mauch Chunk, who held the bonds of the company, for $20,000. The new owners will operate the plants at Mauch Chunk and Lehighton.

NORRISTOWN, PA.—Plans are being considered to place the wires of the municipal electric light plant underground, bids for which work will be received in June. W. G. Risdon is superintendent.

UNIONTOWN, PA.—The City Council has awarded the contract for street lighting to the West Penn Electric Company, of Connellsville, to run until Jan. 1, 1912. Under the terms of the contract the company is to furnish 156 arc lamps at $70 per lamp per year each.

WEST CHESTER, PA.—Plans are being made by the United Telephone Company for extensive improvements to its local system, which includes the installation of a new cable system. The cost of the work is estimated at $50,000.

WESTERLY, R. I.—The Town Council has granted a franchise to the Ashaway & Westerly Railway Company on condition that the road would be completed within one year.

ABBEVILLE, S. C.—The city has entered into a contract with the Abbeville Water, Light & Power Company whereby the city is to become owner of the electric light plant. As the franchise of the company would expire in a little over a year and the electric plant is in need of repairs the company did not care to go to the expense of making them for so short a period, so the city decided to purchase the property and operate it. The price to be paid will be about $12,500 and the city will spend in addition the same amount to put the plant in good condition. It is proposed to call an election to vote on the proposition to issue $25,000 in bonds for this purpose.

BEAUFORT, S. C.—An election will soon be held to vote on a bond issue to purchase the present water works plant or the erection of a new plant and installation of an electric lighting system. For further information inquire of C. A. Townsend.

TOWNER, S. D.—The Northern Valley Telephone Company has been granted a franchise to build telephone lines along the county roads.

WOLSEY, S. D.—It is reported that Mr. Hatcher has been granted a franchise to establish and operate an electric light system in this city.

CHATTANOOGA, TENN.—George Becking, of this city, has been awarded the contract for the construction of the new power house at the Central Depot for $8,000.

CHATTANOOGA, TENN.—Work has been started on the construction of the power-house of the lock and dam at Hale's Bar for the Chattanooga-Tennessee River Power Company. Wilson & Baillie Manufacturing Company, of New York, N. Y., have the contract for the work and expect to have the plant ready for the installation of machinery by Oct. 15. The company is working 24 hours a day, and in order that the crews may work at night it has been necessary to install an electric lighting plant. A large Westinghouse generator is being installed to furnish electricity for lighting the system. At present two small dynamos are in use, which will be held to use in case of emergency. John Bogart, 16 Exchange Place, New York, N. Y., is engineer for the power company.

EL PASO, TEX.—Permission has been granted by the War Department to Mr. Tobin, of this city, to construct a street car line into the military reservation at El Paso.

GALVESTON, TEX.—All bids opened on April 13 for furnishing and installing series arc lamps along the Galveston County Boulevard have been rejected, and new bids will be received on June 8. John H. Murch is county auditor.

PRAIRIE VIEW, TEX.—Bids will be received until June 8 by the Agriculture and Mechanical College, College Station, for electric wiring, etc., for a building to be erected at Prairie View.

TAYLOR, TEX.—The Citizens' Electric Light & Power Company has purchased new equipment for its plant, including new dynamos, boilers, engines and other apparatus, and will discard the old equipment purchased from the Taylor Electric Light Company.

BEAVER CITY, UTAH.—Orders have been placed by the Indian Queen Mining Company with the Utah Mining Machinery & Supply Company for electrical equipment, consisting of a 50-hp compressor, three sets of machine drills and other apparatus, to be installed in the Indian Queen Mine, in Beaver County. Electricity for operating the machinery will be supplied by the Beaver County Power Company from its new plant near Beaver City, the transmission line to be tapped at Newhouse.

SALT LAKE CITY, UTAH.—The Salt Lake City & Ogden Railway Company has decided to equip the portion of its road in Ogden to be operated by electricity immediately. The work as now planned will involve an expenditure of about $500,000 in Salt Lake and Weber Counties. The company attempted to get a temporary permit to operate steam cars in Ogden. Simon Bamberger is president of the company.

ROANOKE, VA.—Plans are being prepared by the Roanoke Water Power Company to light the streets and public places in the city, for which the company has a five-year contract. About 250 arc lamps will be furnished. R. C. Camp is general manager.

SEATTLE, WASH.—The contract for the construction of the Seattle-Tacoma Shore Line Interurban Railway has been awarded to A. D. McInnes. Merle J. Wightman is chief engineer of the company.

SPOKANE, WASH.—Bids will be received until June 23 at the office of James Knox Taylor, U. S. supervising architect, Washington, D. C., for the installation of a conduit and electric wiring system in the U. S. post office, court house and custom house at Spokane.

WENATCHEE, WASH.—The Wenatchee Electric Company is planning to erect a power plant on the Icicle River near Leavenworth. The plant will have an output of 12,000 hp.

ALLENTON, WIS.—The Allenton Telephone Company is planning to extend its system west of Allenton.

ATHENS, WIS.—The Athens Telephone Company contemplates the construction of a number of rural lines.

CHILTON, WIS.—The citizens are contemplating establishing a municipal electric light plant, and a committee has been appointed to investigate the matter. T. J. Glenn is chairman of the committee.

CUMBERLAND, WIS.—The Town Council is considering the question of holding an election to vote on the proposition to issue bonds for the erection of an electric light plant and city hall.

MADISON, WIS.—Bids will be received until June 10 by Lew F. Porter, secretary of the Capitol Commission, for furnishing the pumping apparatus required for the heat, light and power plant now being erected at the capitol, consisting of two horizontal duplex, direct-acting steam pumps, with a rating of 400 gal. each per minute; two horizontal motor-driven centrifugal fire pumps having a rating of 2,000,000 gal. per 24 hours. Plans may be seen and specifications and blank proposal forms secured at the office of the commission.

MILWAUKEE, WIS.—It is reported that bids will be received in July for installing a heating and power plant in the Auditorium Building, the cost of which is estimated at $10,000.

MILWAUKEE, WIS.—Permission has been granted the Plankinton Light & Heat Company to distribute energy for lighting and heating within the territory bounded by the Milwaukee River, Wells Street, Clybourn Street and Sixth Street. The company owns tunnels extending from its power plant westwardly to Third Street and smaller tunnels running under Grand Avenue to connect with the Loan & Trust Building and other buildings on the north side of Grand Avenue. It now proposes to continue the tunnel from Third Street under the alley adjoining the Davidson Theater to Fourth Street.

EDMONTON, ALTA.—The Public Works Department has awarded the contract for the construction of 700 miles of long-distance telephone lines to the Northern Electric Company, of Montreal and Winnipeg.

CRANBROOK, B. C., CAN.—Plans are being prepared by the Cranbrook Electric Light Company for the construction of a hydro-electric power plant to be erected on the St. Mary's River, eight miles from Cranbrook. The equipment will consist of three units of 500 kilowatts each. The company proposes to construct transmission lines to Morgie, a distance of 25 miles, and to Marysville, five miles distant. A. L. McCulloch, of Nelson, is consulting engineer.

KINGSTON, ONT., CAN.—It has been found that the municipal electric plant is supplying electrical energy to the street railway company below cost. The company pays 1.66 cents per kw-hour at the switchboard, and it costs the city 1.94 cents per kw-hour to produce it. It is expected that the question of municipal ownership of the street railway will be submitted to the people at the election next January.

PRESTON, ONT., CAN.—The Town Council has authorized the Mayor and Clerk to enter into a contract with the Hydro-Electric Power Commission for 600 hp at the rate of $23 per horse-power per year. Of this the town is liable for 60 per cent of the total.

TORONTO, ONT., CAN.—The Toronto Electric Light Company has been granted permission to erect a substation at the corner of Tecumseh and Defoe Streets to cost $20,000.

WOODSTOCK, ONT., CAN.—The City Council has authorized the Mayor to enter into a contract with the Hydro-Electric Power Commission for 1200 hp, to be delivered by Dec. 19, 1909.

AIRDRIE, SASK., CAN.—A rural telephone company is being formed here. About 26 miles of pole line will be erected.

WOLSELEY, SASK., CAN.—The Central Light & Power Company writes that it will install additional equipment in its plant in the near future, which will consist of a 150-hp gas engine and suction gas producer and a 90-kw, alternating-current generator.

New Industrial Companies.

THE HENRY F. FARROW COMPANY, of Cambridge, Mass. (electricians), has been incorporated, with a capital stock of $10,000, by Henry F., William G. and William S. Farrow.

THE GENERAL ELECTRIC INSPECTION COMPANY, of St. Louis, Mo., has been incorporated, with a capital stock of $50,000, by Oscar F. Sparta, James K. Gregg and Jesse W. Bassett.

THE BLAKE ELECTRICAL COMPANY, of Portland Maine., has been incorporated, with a capital stock of $100,000. The officers are: H. C. Plummer, president, and C. L. Marston, of Yarmouth, treasurer.

THE W. S. KILMER COMPANY, OF NEW YORK, N. Y., has been incorporated, with a capital stock of $1,500, by William S. Kilmer, George W. Fowler and William Siebenmorgen, of New York City. The company proposes to do electrical work.

THE McMORROW ENGINEERING & CONSTRUCTION COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $10,000, by Patrick McMorrow, James W. McMorrow and Charles P. McMorrow, all of New York, N. Y.

THE MUSSO ELECTRICAL TRANSMISSION COMPANY, of Jersey City, N. J., has been incorporated, with a capital stock of $50,000, by Guiseppe Musso, William P. Voorhees, Charles C. Finkler, of New York.; Charles L. Bowler, of Monmouth Beach, N. J. The company proposes to do a general mechanical and electrical engineering business.

THE TWENTIETH CENTURY ELECTRIC & REPAIR COMPANY, of Akron, Ohio, has been organized for the purpose of doing a general electric, power and repair business. The officers of the company are as follows: C. J. Begler, president and general manager; George J. Shaffer, vice-president; J. M. Hassler, secretary, and F. M. Hanson, treasurer.

THE CARQUINEZ ELECTRIC & CONSTRUCTION COMPANY, Martinez, Cal., has been incorported with a capital of $20,000. The principal place of business of the company will be in Martinez and branches will be maintained at Concord, Antioch and Crockett. E. W. Jensen is the president of the new company, Joseph Mayo is secretary, and the district managers are C. L. Pingree at Concord, F. C. Woolcott at Antioch and M. C. Arnold at Crockett. The purpose of the company is to do a general electrical construction business, to install motors and plants and to deal in electrical supplies. Electrical cooking utensils will also be handled by the company.

New Incorporations.

HUMPHREY, ARK.—The Humphrey Telephone Company has been organized, with a capital stock of $10,000, to construct a telephone system in Humphrey and to construct a line to Altheimer. The officers of the company are: J. T. Stokes, president; C. M. Anthony, vice-president; S. Sachs, secretary, and J. F. Quartermous, treasurer.

LOS ANGELES, CAL.—The Glendora Light & Power Company has been incorporated with a capital stock of $20,000 by J. A. Jones, C. S. Whitcomb, J. A. Weaver, W. Y. Hall and W. E. Wamsby.

RIVERSIDE, CAL.—Articles of incorporation have been filed for the Whitewater Land & Power Company for the purpose of locating, acquiring and developing water rights. The capital stock of the company is placed at $500,000, and the directors are H. Edwin Moore, J. E. Cowles, Arthur E. Poole, of Los Angeles; John E. Coffin, of Whittier, and W. B. Scarborough, of Monrovia.

WILMINGTON, DEL.—The United Electric Company of Cuba has filed articles of incorporation with a capital stock of $50,000. The incorporators are: Louis M. Harvey, Willard D. Farnune, Robert E. Hollinsworth, of Havana, Cuba.

ALTON, ILL.—Articles of incorporation have been filed for the Wood River, East Alton & Bunker Hill Traction Company to construct an electric railway from the site of the new Standard Oil Works, in Madison County, to Gillespie, where it will connect with the Illinois Traction system. The directors are J. T. W. Rudesill, R. M. Smith, S. B. Knepper, D. R. Maxey and B. A. Campbell, of East St. Louis.

CARMAN, ILL.—Articles of incorporation have been filed for the Carmen Farmers' Telephone Company, with a capital stock of $2,500. The incorporators are F. F. Rehling, Thomas Dixon, H. N. Vaughn and others.

DE KALB, ILL.—The Exchange Telephone Company has been organized to construct a telephone system, which is to cover all of De Kalb County north of the Burlington Road.

RUSHVILLE, ILL.—The Pokeberry & Rushville Mutual Telephone Company, of Pokeville Schoolhouse, has been incorporated, with a capital stock of $180, by George S. Garrick, John H. Boice and Henry J. Schroder.

PLEASANT GROVE, IND.—The Silver Valley Telephone Company has been organized and the following officers elected: Carl Holtz, president; Frank Reynolds, vice-president; Jesse Dowden, secretary, and Thomas Bridgewater, treasurer.

FULLERTON, KY.—The Fullerton Power & Light Company has been incorporated by Albert Smith, Frank Swearingen and others.

FORT FAIRFIELD, MAINE.—The Fort Fairfield Light & Power Company has filed articles of incorporation, with a capital stock of $21,000. The officers of the company are: D. E. Edwards, president; H. T. Powers, treasurer.

JACKSON, MICH.—The South Bunkerhill & North Henrietta Telephone Company has been incorporated, with a capital stock of $1,000, by A. A. Call, B. D. Grow, J. L. Artz, George C. M. Titus and others.

PIPESTONE, MINN.—The Pipestone Creek Telephone Company has been organized and the following-named officers elected: J. V. Pierce, president; Herman Buhman, vice-president; E. S. Crossman, secretary, and Henry Gulch, treasurer.

WESTBROOK, MINN.—The Westbrook Telephone Company has been incorporated, with a capital stock of $5,000, by P. J. Johnson, Alfred Arenson, L. L. Hedman, I. O. Iverson and Martin Uvaas.

REEDS, MO.—The Spring Independent Telephone Company has been incorporated to install a local system and to erect a line to Larussell, by J. E. Poncot, Adam Palmer, Joseph Luys, Jesse Burks, G. A. Luys, I. Whaley and others. P. O. address, Reeds Rural Route No. 2.

GLENDIVE, MONT.—The Montana Eastern Telephone Company has been incorporated to construct a telephone line from Glendive to Miles City. The officers of the company are: H. J. Haskell, president; William Lindsay, vice-president; Frank C. Hughes, secretary and manager, and L. R. Barnett, treasurer.

JOY, NEB.—The Pleasant Valley Telephone Company has been organized by John A. Robertson, Harry Spindler, Lysle McRoberts, George Hansen and others. The company has taken over the Verdigris lines from Scottville to O'Neill, and contemplates extensive improvements and extensions to the system.

BAYONNE, N. J.—The Patapsco Electric Company has been incorporated, with a capital stock of $500,000, to generate and distribute electricity. The incorporators are Charles S. Noe, Frederic C. Earl and George Carrigan, of Bayonne, N. J.

ERIN, N. Y.—Articles of incorporation have been filed for the Erin & Swartwood Telephone Company. The capital stock is placed at $750, and the directors are Samuel Houck, J. J. Hollenbeck, Charles W. Park, Marshall F. Drake, Chauncey E. Rosekrane, J. C. Munson, of Erin, and Tyler Woolever, of Swartwood.

MIDVALE, OHIO.—The Midvale Telephone Company has been incorporated, with a capital stock of $10,000, by Robert Jackson, L. G. Kay, C. J. Hallstrom, George W. Williams, A. M. Reed and others.

NORTH BALTIMORE, OHIO.—The North Baltimore Light & Power Company has been incorporated with a capital stock of $30,000 by H. B. Goodloe and others.

OTSEGO, OHIO.—The Northwestern Telephone Company has been organized for the purpose of building a telephone line from this city to Cambridge. The officers of the company are: H. A. Duff, president; Elmer Duff, vice-president; James Stewart, secretary, and Daniel Duff, treasurer.

PLYMOUTH, OHIO.—The Plymouth Telephone Company has filed articles of incorporation, with a capital stock of $4,100, by E. L. Wescott, W. W. Mann, W. G. Holcomb, M. M. Castle and others.

ADAIR, OKLA.—Articles of incorporation have been filed for the Adair Telephone Company. The company is capitalized at $5,000 and the incorporators are: A. W. Herron, S. P. Ferguson, R. E. Delozier and others.

HEWITT, OKLA.—The Hewitt Telephone Company has been incorporated with a capital stock of $1,500, by A. B. Davis, T. J. Pollack, of Sneed; C. J. Gill, of Hewitt; P. R. Davis, of Healdton, and S. T. Ganaway, of Wheeler.

INDEPENDENCE, OKLA.—Articles of incorporation have been filed for the Independence Telephone Company. The capital stock is placed at $1,000, and the incorporators are: J. C. Husted, J. H. Todd, J. L. Goodrich, J. W. Sherrod, B. M. Carr and J. H. Pope.

OKLAHOMA CITY, OKLA.—The Oklahoma City Belt Line Railroad Company has been incorporated, with a capital stock of $250,000. W. W. Bierce, of Oklahoma City, is one of the incorporators.

OKLAHOMA CITY, OKLA.—The Algonquin Light & Power Company has been incorporated, with a capital stock of $100,000, by T. F. Speelman, of Chicago, Ill., and R. S. Galer, of Hanna, Ind., and others.

OKLAHOMA CITY, OKLA.—The Oklahoma, El Reno & Shawnee Rapid Transit Railway Company has been incorporated with a capital stock of $1,500,000. The incorporators are Chas. A. Huber, J. A. Niblo, W. M. Sawyer and S. L. Niblo, of Oklahoma City, and Chas. E. Davis, of Lugert.

SAPULA, OKLA.—Articles of incorporation have been filed for the Farmers' Mutual Telephone Company, with a capital stock of $50,000, by E. E. Coulter, of Chaney; F. M. Moyer, of Alexander, and E. M. Smoot, of Shattuck.

STILWELL, OKLA.—The Stilwell Public Service Company has been incorporated with a capital stock of $50,000 by W. H. Davis, of Stilwell; B. H. Whitaker, of Westville, and Clyde F. Burns, of Chicago, Ill.

WEATHERFORD, OKLA.—The Weatherford Telephone Company has been incorporated, with a capital stock of $15,000, by S. S. Wilks, L. O. Wilks and F. Pigg, all of Weatherford.

CONDON, ORE.—The Wasco County Electric & Power Company has been incorporated to build an electric railway from Condon to Antelope, Madras and Bend, with branches to Howard and Dayville. It is expected that large power plants will be erected on the Deschutes and John Day Rivers to generate electricity to operate the railways. The incorporators are: George S. Carpenter, of Fossil; Mark W. Gill, W. H. Grindstaff, Dr. H. I. Kenney, R. L. Donald, H. J. Martin, O. B. Hathaway, E. P. Schow, C. D. Charles and F. S. Munn.

LINNTON, ORE.—The Home Telephone Company has filed articles of incorporation with a capital stock of $2,500. The incorporators are: M. Crandall, W. F. Harriss, J. C. Noyes and others.

PRINEVILLE, ORE.—The Bear Creek Telephone Company has been incorporated by John Milliorn, James Cram and W. F. Kong.

BALFOUR, PA.—The Farmers' Rural Telephone Company has been organized to construct a telephone system between Carlisle and this city.

HARRISBURG, PA.—The Schuylkill & Dauphin Traction Company has been granted a charter, with a capital stock of $25,000, to build an electric railway connecting towns in Lykens Valley with lines in Schuylkill County at Tower. The incorporators are: J. W. Mayer, secretary; Edgar D. Rank, Malcolm G. Stewart, L. H. Schappell and N. D. Yoder. W. E. Harrington, president of the Eastern Railways Company, controlling the lines about Pottsville, is interested in the company, and as soon as preliminaries can be arranged the Lykens & Williams Valley Electric Railway Company will be absorbed by the new company.

NEWVILLE, PA.—The Big Spring Electric Company has been chartered with a capital stock of $15,000, by D. H. Keller, of Newville; C. W. Hosfield and John Hosfield, of Shippensburg.

PITTSBURG, PA.—Articles of incorporation have been filed for the O'Brien Electric Light Supply Company by W. H. Smith, R. R. McElhany and F. G. Strathmann, of Pittsburg. The company is capitalized at $25,000.

VANDLING, PA.—The Anthracite Telephone Company has been organized to construct rural telephone lines in Susquehanna County. The officers of the company are: S. S. Jones, president; Andrew Mitchell, Jr., vice-president; M. D. Lathropel, secretary and treasurer.

WASHINGTON, PA.—The National Telephone Company, which is a consolidation of the State Mutual Telephone Company, the State Mutual of Caronsburg, the Claysville Telephone Company, the West Alexander Telephone Company, and three farmer companies, has been organized here. The company represents a combined capital of $100,000, and the following officers have been elected: John A. Howard, of Wheeling, president; W. C. Handlan, of Wheeling, secretary, and T. B. Lee, of Crafton, general manager. The new company contemplates making many extensions to its system.

NINETY-SIX, S. C.—The Independent Telephone Company of Ninety-Six has been organized. E. S. Moorer, of Andeson, S. C., will have charge of the construction of the plant.

GEDDES, S. D.—The Farmers' Telephone Company has been organized, with a capital stock of $10,000, for the purpose of constructing an extensive farmers' telephone system in South Dakota. The officers of the company are: K. Schipper, president; C. A. Van Zante, secretary; Peter Nieveen, treasurer, and Nicholas Poelstra, manager.

NASHVILLE, TENN.—Articles of incorporation have been filed for the Home Telephone Company of Trousdale County. The capital stock is placed at $1,000 and the incorporators are: J. H. Rickman, P. E. Burnly, J. B. Johnson, E. M. Haynie, Albert Wakefield and J. E. Faust.

NEW KNOXVILLE, TENN.—The Auglaize Telephone Company has been incorporated with a capital stock of $10,000, by George W. Hall and others.

TELFORD, TENN.—Articles of incorporation have been filed for the Telford Mutual Telephone Company. The capital stock of the company is placed at $5,000.

BULVERDE, TEX.—The East Bulverde Telephone Company has been formed by Alfred Toepperwein, of Bulverde.

DAWSON, TEX.—The New Telephone Company has been organized in this city. D. D. Sawyer is manager.

RICHLAND, TEX.—The Richland Telephone Company has been organized by J. I. McCrary, W. P. McCrary and others, of Richland. The company proposes to install a telephone system in this city, and to extend its lines to Pisgah Ridge, Currie and Corsicana.

SAN ANGELO, TEX.—Articles of incorporation have been filed for the San Angelo Power & Traction Company. The company is capitalized at $50,000, and the incorporators are T. M. Vaughan, J. A. Williams and W. D. Fuller.

SOMERVILLE, TEX.—Articles of incorporation have been filed for the Somerville Light & Ice Company by J. D. Giddings, R. E. B. Bledsoe, of Somerville, and others. The capital stock of the company is placed at $25,000.

WAXAHACHIE, TEX.—The Buena Vista Telephone Company has been organized with a capital stock of $2,000, by C. W. Davis, D. L. Owen and L. J. Paul.

LEDA, VA.—Articles of incorporation have been filed for the Leda Telephone Company. The capital stock is placed at $10,000, and the following officers elected: E. O. Hubbard, of Leda, president; R. L. Coleman, of Riveville, vice-president; W. T. Shotwell, of Cody, secretary and treasurer.

WOODLAWN, VA.—The Galax Mutual Telephone Company has been incorporated, with a capital stock of $7,995, and the following-named officers elected: C. D. Dobyns, president, and W. C. Winesett, secretary and treasurer.

BAKER, WASH.—The Skagit River Telegraph & Telephone Company has been organized, with a capital stock of $5,000, and the following-named officers elected: R. J. Kellogg, president and treasurer; E. C. Miller, vice-president, and J. K. Merz, secretary.

LANGLEY, WASH.—The Whidby Telephone Company has been organized and the following-named officers elected: C. E. Freese, of Clinton, president; J. S. Cattose, vice-president; H. M. McLeod, of Langley, secretary, and H. Bosshard, treasurer.

VASHON, WASH.—The Vashon Island Telephone Company has been incorporated, with a capital stock of $20,000. H. Harrington is president.

ORIENT, WASH.—Articles of incorporation have been filed for the Orient Water Power Company by Arthur Phillips, E. D. Sanders, H. D. Merritt, H. P. Bouffleau and A. D. Mars. The company proposes to furnish water for domestic purposes to the town of Orient and also to generate electricity.

HUNTERSVILLE, W. VA.—The Hills & Browns Creek Telephone Company has been incorporated with a capital stock of $5,000, by C. D. Moore, C. Beverage, Peter McCarthy, C. K. Moore, J. W. Grimes, all of Huntersville.

BROWNSVILLE, WIS.—The Otter Creek Telephone Company has been organized to install a telephone system in this city. F. M. Hollinveck is secretary.

COON VALLEY, WIS.—The Coon Valley Farmers' Telephone Company has been organized in this city and is planning to erect telephone lines between Stoddard and Westburg.

DEER PARK, WIS.—The Deer Park Telephone Company has been incorporated, with a capital stock of $750, by John T. Thompson, Adelbert H. Chadwick and Frank Jabusch.

MAYVILLE, WIS.—The Mayville Rural Telephone Company has been incorporated, with a capital stock of $2,400, by Albert Zastrow, F. A. Justman, H. F. Ringle and others.

MILWAUKEE, WIS.—The Independent Telephone Construction Company, of Milwaukee, has been incorporated, with a capital stock of $10,000, by H. D. Critchfield, S. B. Wayland and R. W. Dunlap.

MILWAUKEE, WIS.—The Southwest Prairie Telephone Company, of Sterling, Vernon County, has been incorporated, with a capital stock of $1,000, by A. P. Bringe, Scott Sanwick, George T. Jerman and others.

MOYIE, B. C., CAN.—The Moyie Telephone & Electric Light Company has been incorporated, with a capital stock of $10,000.

BINBROOKE, ONT., CAN.—The Barton & Binbrooke Telephone Company has been organized by T. E. Tidy, of Hannon; H. Johnston, of Binbrooke; W. Kennedy, of Barton, and N. Laidman, of Binbrooke.

WEST FLAMBOROUGH, ONT., CAN.—The West Flamborough Telephone Company has been organized to construct rural telephone lines. W. C. Hubbell, of Thamesville, is interested in the enterprise.

CANORA, SASK., CAN.—The Canora Rural Telephone Company will soon apply for a charter with power to erect rural telephone lines centering at this city. J. W. Fennell is interested in the project.

Personal.

MR. F. P. FISH has resigned as a director of the General Electric Company. Mr. Fish has during the past year been withdrawing from all corporations with which he was connected, for the purpose of devoting his time entirely to the practice of law.

MR. R. B. FRANCIS, formerly of the Federal Electric Company, Chicago, has recently become sales manager of the Royal Enameling and Stamping Works, of Des Plaines, Ill., with offices at 156 Fifth Avenue, Chicago. This company makes enamelled steel for all purposes, including enamelled reflectors and signs.

HARRIS, CRAVEN & VON BORRIES.—This new firm of engineers and contractors has been formed at Louisville, Ky., with headquarters in the Paul Jones Building. It will do general engineering, but will specialize in civil and mining work and telephone and conduit construction. Mr. J. T. Craven is a railroad engineer of five years' experience, and Mr. W. J. Von Borries has been chief engineer and superintendent of large coal mining properties. Mr. W. R. Harris has had an experience of 14 years, including telephone construction, sewer work, power plants, railway construction and conduit systems for all classes of cables and mains.

MR. ROBERT DAHLANDER has resigned the position of chief engineer for the Swedish State Railways and is now president of the Municipal Gas & Electric Corporation, of Stockholm. Mr. Dahlander was born in Goteborg in 1870 and graduated from the Royal Technical Institute of Stockholm in 1890. He has held positions with several large electrical manufacturing and operating companies in Sweden and abroad, and in 1903 was employed by the board of directors of the Swedish State Railways as expert to supervise the tests to determine the expediency of adapting electric motive power for propelling the trains and also the relative merits of apparatus now available. These tests are now completed, and Mr. Dahlander's report, which has been awaited with great interest by engineers all over the world, has been submitted to the government. The report is published in Swedish, but will be translated into English and German later.

Obituary.

MR. WILLIAM P. BOARDMAN died at his home in Deshet, S. D., May 21, and will be buried in Binghamton, N. Y. Mr. Boardman built the first street railway in America, and superintended the construction of the old New York & Harlem Railway, the line which now nearly corresponds with the Fourth Avenue Railway, and connected the Bowery with Harlem, in New York City.

WILLIAM DANA EWART.—The death at Rome, Italy, on Sunday, May 3, of William Dana Ewart will be noted with keen regret by those whom his genial disposition had made his friends and also by the many others to whom his most prominent invention has made his name familiar. Mr. Ewart was born in Ohio about 56 years ago, and at a comparatively early age gave evidence of an inventive mind and rare mechanical ability. He was the inventor of the malleable-iron, detachable drive chain, first known under his name and in later years as link-belt, which has formed an important part of agricultural and other duplicate machinery and has to possibly a greater extent than any other single invention helped the wonderful progress in the development of elevating and conveying machinery during the past 30 years. This drive chain has been continuously manufactured by the Ewart Manufacturing Company and exploited by the Link-Belt Machinery and Link-Belt Engineering Companies, till in 1906 all three companies were consolidated into the Link-Belt Company, a corporation in which he was largely interested and whose fortunes are still largely directed by his former associates. Mr. Ewart, whose abilities brought their proper reward, was not only an inventor, but a man of executive capacity, possessing a rare gift for harmonizing differences and securing co-operation. His health becoming impaired, he retired in his early prime from the activities of business and sought renewal of physical strength under more favorable climatic conditions abroad.

WILLIAM DANA EWART.

Legal.

AN INJUNCTION TO STOP CONDEMNATION PROCEEDINGS.—An application was made May 19 in the Supreme Court at Columbia, S. C., by John C. Meekin for an injunction restraining the Central Carolina Power Company from instituting condemnation proceedings to secure certain rights at the power development to be made by the Central Carolina Power Company on Broad River between Frost's Mill and Alston. The temporary injunction was not granted, but an order to show cause why the injunction should not be granted was signed by the court and made returnable May 25. The petition alleges that the Act of 1906 granting the charter of the concern is unconstitutional, in that it is special legislation; that it proposes to give rights of a navigable stream to private parties; that it takes private property without the consent of the owner. The Central Carolina Power Company is said to be owned by A. E. Gonzales and W. H. Lyles, of Columbia, S. C.

PRESUMPTION THAT WIRES ARE DEFECTIVE IN CASE OF INJURY BY CONTACT.—Under the law of Missouri, when injury or death is caused by coming in contact with an electric wire, it is conclusively presumed that the insulation on the wire was defective. And it was held not necessary for the plaintiff, in an action against an electric light company for damages for the death of an employee, to prove that the insulation was worn off the wire at the point of contact, where the death occurred under the following circumstances: The plaintiff introduced evidence tending to prove that the kind of insulation used on defendant's wires, at the time and place of the injury, was not reasonably safe for a place of that character; and that "circular loom," a better and safer, insulation could and might have been used by the defendant. The deceased at the time of his injury had been repairing some wires, to reach which it was necessary to pass the wires of the defendant company on his way up the pole. He was familiar with their location, the current they carried and the danger incident to coming in contact with them. The job was an emergency job, and all linemen were pushed. He mounted the pole in safety, and the injury occurred while he was on his way down to the ground. Von Trebra v. Laclede Gaslight Co., Supreme Court of Missouri, 108 S. W., 559.

TELEPHONE COMPANY'S LIABILITY FOR REFUSAL TO RENDER SERVICE IN ACCORDANCE WITH CONTRACT.—The contract between a telephone company and municipal authorities, under which the company was granted franchises to operate lines, provided that the company would render telephone service to parties not living on its lines if such parties would construct a line to within 1½ miles of one of the company's exchanges. In such event the company was entitled to $2 per year for each instrument used. Acting under this provision, another telephone company, with the knowledge of the defendant company constructed a line five miles long, which brought it within 1½ miles of one of the defendant's exchanges. The defendant company, however, refused to connect with the new line, and the company constructing it brought an action for damages to cover the loss it had sustained by the defendant's refusal to connect the lines. The defendant claimed that it was ready and willing to construct a line such as had been erected by the plaintiff company and to furnish telephone service at the regular subscriber's rate of $1.65 per month for each instrument. But it appeared that the defendant company made no offer to construct the line until after the plaintiff company had started the work and, in fact, had it nearly completed, and so it was held that the plaintiff company was entitled to recover damages. If upon being informed of the plaintiff company's intention the defendant had expressed its readiness to construct the line a different case would have been presented. Under the existing facts the defendant was liable as for a breach of contract. Cumberland Telephone & Telegraph Co. v. Cartwright Creek Telephone Co., Court of Appeals of Kentucky, 108 S. W. Rep., 875.

ELECTRIC COMPANY NOT LIABLE FOR INJURY CAUSED BY ITS WIRES UNLESS NEGLIGENCE ON ITS PART IS SHOWN.—An electric light company is not liable for the death of a person resulting from contact with the company's wires merely upon the showing that such an accident occurred. Where one, who went on the roof of a building to inspect some work which had there been done by his employees, and the evidence in the case showed nothing more than that the deceased was found after the accident with the wire which caused his death still clutched in his hand, it was decided that the company was not liable. It was not shown in what manner the deceased came to touch the wire, and, though he was rightfully upon the premises where the accident occurred, still his death might have been directly due to his own negligence. While electric companies are bound to use the highest degree of care practicable to avoid injury to everyone who may be in lawful proximity to their wires, yet the ordinary person is held to know that danger attends contact with the electric wires, and it is his duty to avoid them so far as he may. If one heedlessly brings himself in contact with such a wire, and is injured in consequence, his imprudence must be regarded as a contributing cause, and will prevent a recovery. It is the duty of a plaintiff seeking to recover, when the gravamen of the action is the alleged negligence of the defendant, to show a case clear of contributory negligence on his part. In other words, he must establish a prima facie cause of action, resulting exclusively from the negligence and wrong of the defendant, before the latter need answer at all. In the words of the court: "It may be that the unfortunate man who here lost his life stood clear of contributory negligence, and that his death resulted from something for which he was not responsible, not being under his control; but there was nothing shown in the case upon which such a conclusion could rest." Haertel v. Pennsylvania Light & Power Company, Supreme Court of Pennsylvania, 69 Atl. 282.

Trade Publications.

PRISMATIC REFLECTORS.—The F. Bissell Company, Toledo, Ohio, has issued a bulletin devoted to Holophane reflectors and clusters which it now carries regularly in stock.

SOLDER.—The L. B. Allen Company, Chicago, Ill., has issued a booklet devoted to soldering paste and a leaflet showing how the Allen soldiering stick should be used.

ALTERNATORS.—Belted-type, alternating-current generators rated at from 35 to 200 kw-amperes are treated in Bulletin No. 95 of the Crocker-Wheeler Company, Ampere, N. J.

STORAGE BATTERIES.—Bulletin No. 9 of the General Storage Battery Company, Boonton, N. J., gives a good technical description of "Peimanized" negative storage battery plates.

PISTON PUMPS.—Bulletin No. BK-811 of the Blake & Knowles Steam Pump Works, 115 Broadway, New York, describes vertical duplex piston pumps rated at from 2 to 410 gallons per minute.

COKE-HANDLING MACHINES.—The Covington Machine Company, Covington, Va., has issued an illustrated catalogue devoted to electrically driven machines for drawing coke from ovens and loading it upon cars.

WATER-TIGHT BOXES.—Bulletin No. 21 of the H. Krantz Manufacturing Company, 160 Seventh Street, Brooklyn, N. Y., is a 52-page publication relating to standard and water-tight boxes for all electrical purposes.

TESTING INDUCTION MOTORS.—The Triumph Electric Company, Cincinnati, Ohio, has issued a vest-pocket folder giving directions, symbols and formulas for determining the performance of polyphase induction motors.

THE F. BISSELL COMPANY, of Toledo, O., has issued a neat calendar for May, with a bit of crooked wire tied to it, emphasizing the crookedness of making up for low prices by inferior quality, low weights or short counts.

SWITCHBOARD PANELS.—Constructive details of direct-current switchboard panels for emfs of from 125 to 250 volts are given in an illustrated bulletin of the Crocker-Wheeler Company, Ampere, N. J., designated as No. 97.

VALVES.—The 1908 catalog of the Lunkenheimer Company, Cincinnati, Ohio, is a 564-page publication devoted to descriptions and price lists of brass and iron valves, whistles, cocks, gages, injectors, lubricators, oil pumps, oil and grease cups, etc.

LUMINOUS ELECTRIC RADIATORS consisting of ornamental cast-iron frames, each fitted with a polished copper reflector at the back and with three or more large cylindrical incandescent heating lamps, are described in an attractive pamphlet recently issued by the General Electric Company, Schenectady, N. Y.

PRISMATIC REFLECTORS.—Bulletin No. 6 of the Holophane Company, New York, is devoted to prismatic reflectors for gem meridian, tantalum and tungsten lamps. For use with the latter type of lamp the company recommends bowl reflectors in sandblast on enamel finish, on account of the excessive brilliancy of the lamp filament.

SERIES TRANSFORMERS.—Catalogue 7 of Ferranti, Ltd., Hollinwood, Lancashire, England, describes open type series transformers. The windings are insulated with mica and impregnated linen cloth on porcelain. The transformers are intended for use with measuring instruments and are built for switchboard mounting or in portable form.

HIGH-TENSION INSULATORS.—The Central Electric Company, Chicago, is distributing a 47-page book devoted to various types of porcelain insulators, covering all voltages found in commercial practice. This catalog on insulators will be mailed upon request, and should be found interesting by consulting engineers, and others interested in high-tension work.

STURTEVANT GENERATING SETS.—Bulletin No. 156, of the B. F. Sturtevant Company, illustrates and describes generating sets, direct-connected to vertical compound engines. Sturtevant generating sets of this type are now built in standard sizes, and from 150 to 500-kw, consisting of vertical and compound enclosed engines, direct-connected to ten-pole generators.

NERNST LAMPS IN CHICAGO.—The May issue of the *Glower*, published by the Nernst Lamp Company, Pittsburg, Pa., gives an illustrated description of the large stores and business houses in Chicago. These installations were considered to afford to students of illumination such a broad field for observation that the company felt that it was unnecessary to arrange a special exhibit at the recent National Electric Light Association Convention.

DIRECT-CURRENT MOTORS.—Bulletin No. 98 of the Crocker-Wheeler Company, Ampere, N. J., describes belt-type, direct-current motors rated at from .05 hp to 5 hp. Bulletin No. 99 of the same company gives an outline of the direct-current motor equipment of the Bethlehem Rail & Structural Mills, where 230-volt machines are used. Belt-driven motors rated at from 5 hp to 45 hp and generators rated at from 45 kw to 40 kw are described in Bulletin No. 100.

WEBER GAS ENGINES.—The Weber Gas Engine Company, Kansas City, Mo., has issued a folder which gives details of an electric light plant in a town of about 1000 inhabitants, which, when financial failure was staring them in the face, due to the lack of economy of the steam power plant, bought and installed a Weber gas power plant. The striking economical performance of the new plant, 1 1/5 lb. of coal per hp-hour, including stand-by losses with repairs of less than $5 in three years, turned a deficit into a comfortable dividend each year.

CLEANING MACHINERY.—The General Compressed Air & Vacuum Machinery Company, 4436 Olive Street, St. Louis, Mo., has issued an extremely artistic catalogue dealing with stationary and portable cleaning equipments built under the Thurman patents. The stationary equipments are driven by an electric motor, which starts automatically when conveniently located push-buttons are depressed. The catalogue contains a long list of hotels, office buildings, theaters, residences and clubs where compressed air and vacuum cleaning equipments are now in use.

INSULATING COMPOUNDS.—The Minerallac Company, of Chicago, Ill., has just issued a catalogue describing insulating compounds and electrical specialties. The cover of the catalogue, which is beautifully engraved, is designed to serve as a receptacle for future bulletins as they are issued by the company. The catalogue contains descriptions of methods recommended for eliminating cable-joint failures, descriptions of the quick-action voltmeter switch. portable cable-testing sets, Minerallac cable and conduit-hangers, and the company's printing attachment for watt-meters.

DIRECT-CURRENT MOTORS.—The General Electric CQ motor is described in detail in a 16-page bulletin designated as No. 4584. This motor, which is for direct-current circuits, is made in ratings up to 20 horse-power and for e.m.fs. of 115, 230 and 550 volts. Descriptions are given of belt-tightener attachments, back-geared devices, motor-generator sets consisting of two CQ motors connected rigidly together, etc. The application of the motor to linotype equipments, ventilating outfits, machine tools, etc., is also outlined. The extensive tables of dimensions, capacities, etc., in the bulletin will be found very useful in preparing specifications.

RHEOSTATS.—The Ward Leonard Electric Company, Bronxville, N. Y., has ready for distribution the following new catalogs: Catalog A2, covering motor starters with switch and fuse attached; Catalog A4, covering navy type motor-starting panels, approved by the Bureaus of Construction and Equipment, Repair and Steam Engineering; catalog A7, covering motor-starters equipped with 20 steps of resistance for speed control by field regulation; catalog A9, motor-starters arranged for back of board mounting; catalog A10, reversing motor-starters; catalog A12, self-starters; catalog B1, motor speed controllers; catalog H1, battery charging rheostats, and catalog F1, theater dimmers.

LUMINOUS ARC HEADLIGHT.—Under the title "Two Aids to Better Service," the General Electric Company, Schenectady, N. Y., has issued a folder (No. 3654) calling attention to some of the reasons why the G. E. luminous arc headlight has been adopted. On the front page are pictures of the headlight and the Belmont Tunnel, New York, the "Two Aids to Better Service." Among the advantageous features of this headlight are economy in operation, efficiency, convenience, reliability and low maintenance cost. A list of a few of the roads now using them is included.

WORK ON FIVE CONTINENTS.—An 82-page booklet printed in two colors and containing a choice collection of artistically arranged views from all parts of the world has been published for giving an account of the activities of the following associated organizations: J. G. White & Company, Inc., New York; J. G. White & Company, Ltd., London, England; Waring White Building Company, London, England; Canadian White Company, Ltd., Montreal, Canada. Brief outlines are given of more than one hundred important developments in India, Australia, New Zealand, the Philippines, South America, Continental Europe, the British Islands, Canada, Mexico and the United States. It is stated that the value of contracts now on hand by the associated organizations amounts to more than $50,000,000.

RAILWAY MOTOR CONTROLLERS.—Bulletin No. 4578, recently issued by the General Electric Company, Schenectady, N. Y., describes in a comprehensive manner the essentials of the various standard controllers that are manufactured for railway service, with special reference to the operating conditions for which each type is suited. Among the controllers described are type B, which include the necessary contacts and connections for electric braking, type K for series parallel operation of the motors, type L, also in the series parallel class, but which completely open the power circuit when changing from series to parallel, type R, which are designed to control the motor speeds by means of resistance only, and a brief outline of the Sprague-General Electric type M control system.

ALLIS-CHALMERS CORLISS ENGINES.—Allis-Chalmers Corliss engines are now equipped with a valve gear having a new steel detaching device which does not show excessive wear, due to operation. Wear often becomes so great in inferior types of construction that the pin will loosen with running and serious results follow. This difficulty and others incident to the older style are eliminated by the new arrangement, which is described in Allis-Chalmers Company's Bulletin No. 1505. Another desirable feature in the valve gear and regulator is to be found in the safety stop shown. This consists of blocks of steel on the cut-off cams which come into position and shut off the steam should the governor belt break. An automatic arrangement is also provided so that these blocks are inoperative when the engine is starting.

BOULEVARD LIGHTING SYSTEM.—The Jandus Electric Company has issued a pamphlet descriptive of the Daniels boulevard lighting system, which forms one of the handsomest specimens of trade literature thus far issued from the press. The design is both artistic and effective, and the engraving is of a remarkably high quality. The pamphlet was executed by Corday & Gross, of Cleveland, upon whom it reflects high credit. The publication describes and illustrates the system of boulevard lighting designed by Mr. W. E. Daniels, engineer of the South Park Commission, of Chicago, the manufacture and exploitation of which has been undertaken by the Jandus Company. In this system each unit consists of a reinforced concrete base, shaft and capital, of Ionic design, the whole surmounted by a complete arc-lamp mechanism within a 20-in. opal glass ball globe. The artistic illustrations bring out strongly the highly artistic effect of this disposition, a variation of which is also shown applied to wall brackets.

MOTOR-DRIVEN ICE BREAKER.—This booklet, while devoted primarily to the description of the Creasey ice breaker, contains in addition much information of interest to those who have to do with ice for packing, shipping or refrigerating food products. The Creasey ice breaker, which is manufactured by Joseph S. Lovering Wharton, of Philadelphia, Pa., consists essentially of a revolving cylinder carrying sharp picks, mounted in a suitable frame, which provides for feeding the cakes of ice against the cylinder by gravity. The revolving picks split the ice from the cake, the size being determined by a "comb," through which the pieces must pass before falling out below. The picks consist of round, tapered pieces of steel set in a tapered socket drilled and reamed in a lug cast on the drum. The pick is held solely by friction, no rivets, nuts or wedges being required. The machines are built in a varied range of sizes, from small hand-driven machines for family use up to a machine that will cut from 40 to 50 tons of ice per hour and will take cakes of ice 22 in. thick by 32 in. wide and of any length.

IMPROVED RESISTANCE UNITS.—Bulletin No. 4587 of the General Electric Company has for its subject a new type of resistance unit for rheostats, fixed resistances, laboratory use, etc., which contains many important improvements in design and construction. The unit consists of a wire wound tightly on a specially formed tube. The resistance material has a negligible temperature coefficient so that the ohmic value of the unit is practically the same at all times whether hot or cold. The tube is made up of a durable cylinder treated with a special insulating compound which forms a coating both inside and out. This makes a reinforced construction that is not brittle, and is strong and solid. The unit is made in two forms, one having porcelain bushings at the end with wire terminals, and the other having metal bushings connected to the winding and suitable

for holding in metal grips, and of a size to fit into standard fuse holder clips. The Bulletin describes both forms of units and gives the size, ratings, capacities, etc., of the standard types.

TANTALUM AND GEM LAMPS.—Bulletins Nos. 4561 and 4566, of the General Electric Company, have for their respective subjects tantalum and Gem incandescent lamps. In Bulletin No. 4566 the tantalum lamp is specially recommended to central stations as a desirable factor in the reducing of peak load conditions. Stress is laid on the brilliant and attractive quality of light emitted by the tantalum lamps, qualities which make it most desirable for hotels, theatres, cafés, stores and all public buildings. A table shows the actual amount saved in dollars and cents by the use of these lamps. Several pages are devoted to the elucidation of a practical method for the solution of illuminating problems. The illumination table intended for use in connection with this method is comprehensive for 80-watt lamps with three types of holophane reflectors, and by interpolation can also be used for the 40-watt and 50-watt tantalum units. Several curves giving the candle-power distribution with different types of holophane reflectors are also shown. Bulletin No. 4561 contains information in regard to Gem high-efficiency incandescent units. These lighting units are composed of the Gem lamps with varying types of holophane reflectors and are made in 100, 125, 187 and 250 watt sizes. Candle-power values of these lamps are not given, as it is obvious that these values will vary according to the type of reflector used. A method of solving illuminating problems is given, and the subject of illumination in general taken up and treated briefly. This is followed by a specific treatment of the subject with reference to Gem high-efficiency units. Assuming the degree of illumination desired, a problem is worked out, reference being made to the illumination tables for the solution. Two photographs are shown of the interior of a dry goods store before and after the installation of Gem units. The original installation consisted of six-light electroliers with ordinary 16-cp incandescent lamps, placed 7¾ ft. from the floor. The Gem installation consisted of 125-watt, high-cp units with bowl holophane reflectors. These units were installed on the ceiling 14 ft. above the floor.

Unclassified Items.

CASEY, ILL.—The Charleston & Casey Traction Company has been incorporated with a capital stock of $2,500 by H. R. Patton, of Charleston, William Stull, of Charleston, and S. S. Yanaway, of Casey, Ill.

CHARLESTON, W. VA.—The Aerial Tramway Company has been incorporated with a capital stock of $1,000,000, to build and operate aerial tramways and hold patents relating thereto. The incorporators are: Harry Frazier and D. C. T. Davis, of Lewisburg, and others.

KOKOMO, IND.—Articles of incorporation have been filed for the Kokomo, Frankfort and Terre Haute Traction Company with a capital stock of $100,000. The company proposes to construct and operate an electric railway between Frankfort and Terre Haute and intervening cities, and to install and operate power plants in cities and towns along the route for the distribution of electricity, and will also operate street railway systems in several of the towns connected by the interurban line. The directors of the company are: Martin W. Eikenberry, Joseph C. Dewees, E. B. Swift, Robert N. Ross and Oliver Guard are the directors.

SUMMERVILLE, S. C.—The Charleston & Summerville Electric Railway Company has decided to increase its capital stock by $400,000. It is expected that work on the construction of the road will commence soon.

WALLA WALLA, WASH.—Rights of way for a power house, flume and water privileges on the South Fork of the Walla Walla River, several miles above the present power plant of the Northwestern Gas & Electric Company have been secured by the Trustees of the Washington & Oregon Traction Company, which proposes to construct a 5000-hp plant in the near future to furnish electrical energy to operate the proposed electric railways in the Walla Walla Valley and surrounding country. Rights of way have been secured by the company to the summit of Blue Mountains, about 330 miles distant from Walla Walla. The new enterurise is being financed by local capitalists and is managed by a board of trustees composed of E. S. Isaacs, Max Baumeister, C. K. Holloway, Allan H. Reynolds, Samuel Drumheiller, John Smith, W. A. Ritz and John L. Sharpstein.

TAMPA, FLA.—It is reported that work will be resumed on the construction of the Peninsular Street Railway about June 1. The road when completed will run from Tampa to Bartow, via Plant City and Mulberry. Work was stopped last fall at the time of the panic. The power house will be located at Plant City. J. F. Davis is superintendent of construction.

DETROIT, MICH.—Sealed proposals will be received at the office of the Public Lighting Commission, 40 Atwater Street, East Detroit, until June 4, for furnishing cedar poles, electric light carbons, copper and steel wire, cross arms, cross-arm braces, Hemingray W. U. No. 5 glass insulators, common black iron pipe and floor flanges for the same; Stombaugh guy anchors, pole pulleys and porcelain insulators. F. T. Bowler is secretary of the commission.

SAN FRANCISCO, CAL.—The United Railroads has awarded contracts for additional electrical equipment at its North Beach power station, which will more than double the present output of the plant, consisting of a new steam turbine, frequency changer, new boilers, and other apparatus. The cost of the work is estimated at $375,000.

MENOMINIE, MICH.—The Menominie Electric Light & Power Company has closed a contract with the Chippewa Valley Railway, Light & Power Company for electrical energy to operate its system.

JEFFERSON, WIS.—The citizens have voted to issue $7,500 in bonds to purchase the interest of Charles Hoppenbach estate in the mill dam across Rock River. The municipality acquires three-eighths interest in the dam, a woolen mill equipped with the necessary power machinery, which will permit the city to furnish a 24-hour service and to furnish electrical energy to factories and other industries.

DELTA, COL.—The plant of the Delta Electric Light Company was destroyed by fire, causing a loss of $9,000.

CUERO, TEX.—The plant of the Buchel Power & Irrigation Company, situated at the dam about three miles from this city, is reported to have been destroyed by fire, entailing a loss of about $40,000.

BOSTON, MASS.—Acting Governor Draper has signed the bill allowing the consolidation of gas companies with gas companies and electric light companies with electric lighting companies throughout the state. The bill especially provides that no gas and electric company shall be consolidated and names separately the Edison Illuminating Company and the Boston Consolidated Gas Company.

EXCELSIOR SPRINGS, MO.—Plans are being considered to construct an electric railway in this city, for which an application will soon be made to the City Council. Henry J. Arnold is interested in the enterprise.

KOKOMO, IND.—It is reported that the Kokomo, Frankfort & Terre Haute Traction Company, recently incorporated, will soon ask for bids for the construction of the first section of the railway between Kokomo and Burlington, a distance of 12 miles. William H. Eikenberry, J. C. Deweiss and E. B. Swift are directors of the company.

EAST ST. LOUIS, ILL.—The stock of the Southern Illinois Traction Company has been increased from $2,500 to $1,500,000.

PITTSBURG, PA.—The Joplin & Pittsburg Railway Company has awarded the contract for the construction of the overhead work, including the wiring, stringing of trolley wire and carrying the high-tension lines from Lowell to Asbury and Turkey Creek station and along the road, to the Smethurst & Allen Company, of Philadelphia, Pa., for $25,000. This amount covers construction work only. The railway company proposes to transmit electrical energy from the Lowell power station to the substations at Turkey Creek and Asbury on three high-tension lines of 30,000 volts each. The poles will also carry three telephone wires, and about 400,000 lb. of copper wire will be used.

OXFORD, MISS.—The Building Committee has recommended to the Board of Trustees of the University of Mississippi that the plans submitted by Engineer Prout, of Memphis, for the power plant for lighting and heating the university buildings be adopted, the cost of which is estimated at $35,000.

CHICOPEE, MASS.—The Board of Aldermen has granted a franchise to the Springfield Street Railway Company to construct and operate a street railway on East Street.

MANHATTAN, NEV.—The California-Nevada Power & Light Company contemplates extending its transmission lines to Manhattan and Round Mountain. It is proposed to extend the lines from Millers siding.

Business Notes.

JOHN T. WILLIAMS & SON have removed their sales office to the Engineering Building, 114 Liberty Street, New York.

BAKER & COMPANY, INC., of Newark, N. J., have moved their New York office to the sixth floor, Cortlandt Building, Hudson Terminal, 30 Church Street.

JENKINS BROS., 71 John Street, New York, have removed their Chicago store from 31 North Canal Street to larger quarters at 226 Lake Street, corner of Franklin Street.

MR. A. A. KNUDSON has removed his offices from the Mutual Life Building to 50 Pine Street, where, with increased facilities in the way of office room and new standard instruments, he is enabled to carry on the work of electrolytic examination to better advantage than in the past.

THE ERNER & HOPKINS COMPANY, of Columbus, Ohio, has secured contracts for rewiring and remodelling the electrical equipment of the plant of the American Bottle Company at Streetor, Ill., and furnishing the complete electric outfit for the new sugar plant of the Ohio & Texas Sugar Company at Brownsville, Tex. W. A. Hopkins is president of the company.

FRINK INSTALLATIONS IN ART GALLERIES, ETC.—The matter of properly lighting galleries, museums, public buildings and individual pictures is more and more becoming recognized as one of prime importance, and as a consequence the expert knowledge on this subject of I. P. Frink, 551 Pearl Street, New York, is increasingly sought. Fifty years' experience in successfully lighting the finest public and private art galleries and public buildings, as well as individual pictures, is sufficient evidence that the confidence in this firm's competency is not misplaced. Among the recent installations by this firm may be mentioned those in the Albany Historical Society, Albany, N. Y.; the Carnegie Institute, Pittsburg, Pa.; the lighting of the mural paintings in the Essex County

Court House, Newark, N. J.; the Camera Club; the Bauer-Folsom Art Galleries; Georges A. Glaenzer & Co.; the Metropolitan Museum of Art and the Museum of Natural History, New York City.

THE UNION ELECTRIC COMPANY has opened a store at 414 Wood Street, Pittsburg, Pa., where it will carry a complete line of electrical supplies.

MR. S. L. GROSSMAN, formerly of the Nernst Lamp Company as sales representative, is now in charge of the sales department of the Safety Electric Company, located at 35 Michigan Avenue, Chicago, Ill., engaged in the renewed lamp business.

MR. W. A. EKBERG, Pacific Coast representative of The Hart Manufacturing Company, Frank Adam Electric Company, Condit Electric Manufacturing Company, The Peerless Electric Company, The Sachs Company, Enameled Metals Company, Hartford Time Switch Company and Willard Storage Battery Company, has removed his offices to 143 Second St., San Francisco, Cal.

THE AMERICAN ELECTRIC LAMP COMPANY OF NEW YORK, whose New York office was located at 26 Cortlandt Street, has arranged with the Central Electrical Supply Company, 29 West Fifteenth Street, to become its sole selling agents in Greater New York. The agency expects to carry at all times a stock of from 50,000 to 75,000 lamps, which should insure prompt delivery of orders.

THE CENTRAL ELECTRIC COMPANY, Chicago, general Western sales agent for "Pittsburg" transformers, has completed delivery on a recent contract for lighting transformers to be used by the South Park Commissioners. The transformers furnished on this contract are the latest high-efficiency type. The same company is delivering a number of the same type of transformer to the U. S. Government for use at Charleston, S. C.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED MAY 19, 1908.

[Conducted by Rosenbaum & Stockbridge, Pat. Attys., 41 Park Row, N. Y.]

887,748. SIGNALING SYSTEM; Garrison Babcock, Rochester, N. Y. App. filed July 7, 1905. A locking out means whereby, when one substation is in use for telephonic or telegraphic purposes, another station is prevented from using the line or interfering with the conversation or signals from the first station.

887,769. ELECTRICAL CURLING IRON; Trevor M. Caven, Kansas City, Mo. App. filed Dec. 11, 1906. Construction of curling iron having a spiral resistance element imbedded in the solid prong and which is controlled by a push button switch in the handle.

887,774. SELF-PLAYING ATTACHMENT FOR PIANOS; George Howlett Davis, West Orange, N. J. App. filed Sept. 21, 1905. The piano has a continuously rotating drum with a friction surface which is engaged by depending arms controlled by electromagnets for each key.

887,776. ELECTROPLATING APPARATUS; Charles E. De Long, Shreveport, La. App. filed Oct. 4, 1907. A small electroplating apparatus comprising a case having a battery and a solution tank, and specially constructed switch connections for controlling the current flow.

887,805. POSITION INDICATOR FOR GRAIN DISTRIBUTING DEVICES; Harry B. Higgins, Minneapolis, Minn. App. filed March 30, 1907. Has a multiplicity of laterally placed storage bins and a distributing device, including a position indicator at a distant point, controlled by a four-wire pilot circuit.

887,822. ELECTRICAL CONTACT; Richard F. LeBrocq, of Etna, N. J. App. filed March 24, 1906. Relates to mechanism for making electrical contacts by delicate automatic mechanism, such as a chronometer. Has a compound lever displaced by a cam and carrying the movable contact.

887,840. PUSH BUTTON SWITCH; Peter A. Paul, Lewisburg, Ohio. App. filed Aug. 15, 1907. Push button switch having a bridging conductor which is forced into contact with circuit terminals by a cam mechanism. The circuit is broken by the resiliency of the bridging conductor, whereby the latter breaks the circuit when relieved from the action of the cam mechanism.

887,868. TROLLEY WIRE SUPPORTING DEVICE FOR BASCULE BRIDGES; Joseph B. Strauss, Chicago, Ill. App. filed Jan. 28, 1907. A trolley wire supporting device for a bascule bridge. Makes use of a flexible section which is kept stretched taut by a weight.

887,871. ELECTRIC HEATER; Clarence L. Taylor, Alliance, Ohio. App. filed Aug. 24, 1907. The flat-iron is made with a pair of plates which can be separated to include between them a pair of spiral flat windings constituting resistance elements.

887,877. INSULATOR; Henry Trumbull, Plainville, Conn. App. filed March 2, 1907. A form of bushing for outlet boxes and the like, having an insulating sleeve with a flange which is engaged between a pair of metallic collars, one of which is threaded into the wall of the outlet box.

887,887. PARTY-LINE TELEPHONE SYSTEM. Thomas L. Wilson, Ottawa, Ontario, Canada. App. filed May 28, 1907. In a telephone substation, the combination with a plurality of telephones connected in multiple of an auxiliary independent signaling circuit, normally incompleted, a plurality of pairs of leads extending from opposite sides of the auxiliary circuit to the respective telephones, and means operated by the use of any one telephone for connecting the pair of leads corresponding thereto.

887,896. TIE WIRE CLAMP; George Wrigley, Greenville, S. C. App. filed June 21, 1907. Has a pair of sheet-metal plates which are fastened together by bolts so as to strap around an insulator and engage the wire.

887,907. SWITCH BASE; William R. Atkinson, New York, N. Y. App. filed Aug. 16, 1906. Makes use of a porcelain block which has the dimensions of the ordinary wooden molding used with electric wiring and contains grooves registering therewith.

887,918. AUTOMATIC CUT-OFF FOR ELECTRIC CURRENTS; Domingo Cervera Cañizares, Paris, France. App. filed June 26, 1905. An apparatus for cutting off the current at a subscriber's station after a predetermined maximum is attained. Is a form of magnetic cut-out.

887,923. ELECTRIC HEATER AND COOKER; Ella M. Crandall, Dolgeville, Cal. App. filed June 28, 1907. A porcelain block has a sinuous passage therein which contains a spiral resistance element. The whole is intended to be submerged in the water of an outer jacket of the cooking vessel.

887,930. MEANS FOR ATTACHING LINE WIRES TO INSULATORS; Chester J. Elliott, Beaver River, N. Y. App. filed Dec. 14, 1907. A means for fastening line wires to insulators, comprising a stirrup-shaped member made preferably of wire and bent upon itself to form hooks adapted to receive the line wire, the ends of the stirrup-shaped wire being adapted to be drawn together by means of a lever, thereby causing the line wire to be held tightly against the insulator.

887,932. ELECTRIC RAILWAY SYSTEM; Samuel C. Frey, York, Pa. App. filed Nov. 28, 1906. A car stopping and signaling block system adapted for single-track roads, having a signal system and train-stop device whereby the signals are enforced.

887,943. INCANDESCENT ELECTRIC LAMP; Marshall D. Jones, Davenport, Ia. App. filed April 30, 1907. The globe of the lamp is made hemispherical in transverse section and is silvered on its rear face to constitute a reflector. The filament is flattened to correspond with the outline of the globe.

887,947. ELECTRICALLY HEATED SAD IRON; Frank Kuhn, Detroit, Mich. App. filed Sept. 14, 1907. An electrically heated sad iron comprising a base section, a removable hood section, and a heating element secured to said base section within said hood. Has a terminal permanently attached to said heating element and projecting outward through an aperture in said hood.

887,949. THERMOSTAT; Christian J. Letzing, Boston, Mass. App. filed Feb. 28, 1907. A thermostat for use in factories. Has a pair of terminals in the same horizontal line and spring-impelled together, one of said terminals having a fusible washer adapted to permit movement of the spring-impelled terminal.

887,965. ELECTRIC GAS LIGHTER; Raymond A. Rockwood, Monrovia, Cal. App. filed April 10, 1907. Electric gas lighter adapted to be operated by a push button. Makes use of a magnet-displaced ratchet wheel having teeth of alternately different character, whereby successive closures of the circuit alternately turns on and off the gas.

887,980. ELECTRICALLY CONTROLLED SWITCH OPERATING MECHANISM; Karel Willem Gerard Johan Stoffels and Johannes Jacobus Hendrikus Wilhelmus Weenen, Amsterdam, Netherlands. App. filed Jan. 23, 1907. A track switch having a pair of operating magnets selectively controlled by a pair of conductors supported adjacent to the trolley wire.

887,996. COMBINED INSULATOR AND LAMP HANGER; James M. Burge, Decatur, Ill. App. filed Oct. 5, 1906. A bell-shaped hanger has a metallic strap in a groove of the insulator, which has a central hook to support the lamp.

887,998. TELEPHONE AND CIRCUITS THEREFOR; Edward E. Clement, Washington, D. C. App. filed June 20, 1903. Details of subscribers' circuit having a specially constructed and arranged repeating coil.

888,050. FIELD MAGNET WINDING; Julian A. Stratton, Chicago, Ill. App. filed March 31, 1906. Construction of field magnet of direct-current generator, designed to permit of automatically shifting or displacing the magnetic field whereby good commutation may be obtained under varying conditions of load or speed without having to shift the brushes.

888,067. ELECTROPLATING APPARATUS; John T. Daniels, Newark, N. J. App. filed June 7, 1907. Electroplating apparatus having a tank or vat in which the electrolyte is contained and in which is placed a rotatable drum containing the articles to be plated.

888,068. ELECTROPLATING APPARATUS; John T. Daniels, Newark, N. J. App. filed July 29, 1907. Relates to modifications of the above.

888,076. PROCESS OF MAKING BUTTER; George V. Frye and Frank B. Hinkson, Lexington, Ohio. App. filed Oct. 26, 1907. Consists in cooling unripened cream and subjecting the same to an electrolytic action.

888,093. ELECTROPLATING APPARATUS; Willis R. King, Newark, N. J. App. filed Dec. 15, 1905. Form of electroplating apparatus having a hollow drum within the tank or vat and which contains the articles to be plated.

888,096. CABLE TELEGRAPHY; Isidor Kitsee, Philadelphia, Pa. App. filed May 1, 1907. Has a line with a condenser included therein and a shunt circuit including a polarized receiving instrument, a resistance, and a serially connected condenser.

888,098. AUTOMATIC PHOTOTELEGRAPH; Arthur Korn, Munich, Germany. App. filed May 2, 1907. Selenium cell apparatus having detail features.

888,099. THIRD-RAIL ELECTRIC RAILWAY SYSTEM; Charles Kozesnik, New York, N. Y. App. filed Oct. 30, 1906. A hollow third rail for electric railways consisting of top and bottom portions provided with laterally directed side flanges separated by insulating material, said side flanges and insulating material being interlocked.

888,151. ELECTRIC WATER HEATER; Oscar H. Fiddes and Herman A. Seifke, San Francisco, Cal. App. filed Dec. 18, 1907. An ornamental device for heating water having a hollow standard containing a resistance element through which the water flows. A glass globe is supported on the upper portion of the standard and contains an electric light, so that the device makes an ornamental parlor or table ornament.

888,153. SYSTEM FOR SELECTING ONE OR SEVERAL RECEIVERS CONNECTED TO A COMMON CONDUCTOR; Adolf Franke, Halensee, near Berlin, Germany. App. filed Dec. 23, 1907. An electric system for selecting one of several receivers connected to one common conductor. Is particularly adapted for party line telephone systems.

888,154. INSULATOR; Howard Friend, Lexington, Okla. App. filed Oct. 7, 1907. Has a specially formed split casting which embraces a two-part cylindrical insulator, so that the single fastening bolt used clamps all the parts tightly in place.

888,157. ELECTRIC AWNING OPERATOR; Egisto U. Giovannoni, New York, N .Y. App. filed Nov. 23, 1906. A device especially adapted for raising and lowering awnings, designed to operate automatically without attention on the part of the operator after being started either to raise or lower the awning to the desired point at which the same is stopped automatically.

888,191. OSCILLATION-RECEIVER; Greenleaf W. Pickard, Amesbury, Mass. App. filed Nov. 9, 1907. An oscillation-receiver, which consists of two electrical conductors, one of which is of brass and the other of which is a mass of silicon having a polished surface.

888,211. TELEPHONE INSTRUMENT; Minor Waters, Albany, N. Y. App. filed July 12, 1907. In an instrument of the character set forth, the combination with a telephone instrument having a switch, of a receiver support movable toward and from the switch, and switch actuating means operated by the support and engaging the switch, a portion of said means constituting a stop that engages the switch to limit the movement of the support away from the switch.

888,223. TROLLEY POLE; George W. Chatmond, Louisville, Ky. App. filed Nov. 7, 1907. Has a pivoted trolley pole with spaced engaging means thereon, and a pivoted supporting member engaged upon said means to hold the trolley pole in selected adjusted positions.

888,235. LIGHTNING ARRESTER; Edward S. Halsey, Palmetto, Fla. App. filed Dec. 10, 1904. A form of lightning arrester or protecting device for removing static charges from electrical circuits and for protecting such circuits from lightning and other abnormal potentials. Has a fluid column designed to be suddenly vaporized and thus automatically interrupt the circuit of an arc formed.

888,241. PROTECTIVE DEVICE; Karl Kuhlmann, Berlin, Pankow, Germany. App. filed Nov. 20, 1906. A means for protecting electrical distribution systems from injurious excess potentials. Makes use of a pair of electrodes for the lightning arrester spark gap, which are movable toward and from one another under the influence of electrostatic forces, so that they approach to permit a lightning discharge, but immediately separate after this excessive potential has passed.

888,275. ELECTRIC CONDENSER; Matthew O. Troy, of Lynn, Mass. App. filed March 31, 1902. A form of condenser having sheets of tinfoil separated by a pair of sheets of paper, one of which is varnished and the other impregnated with wax.

888,277. ELECTRIC HEATER; Hjalmar Wahlquist, Philadelphia, Pa. App. filed Dec. 12, 1907. The cover of the receptacle has a depending tubular body which contains a double spirally wound resistance element.

888,285. ELECTRIC LOCK; Solomon W. Wibel, Nathan J. McAloney and William R. Cunningham, Denver, Col. App. filed Jan. 29, 1906. An electric lock mechanism having a latch with a locking device moved through an electromagnet. The latch has a rigid arm which constitutes the armature of the magnet and is directly tilted upward thereby.

888,304. PRODUCTION OF FERTILIZERS, FILTERING MATERIALS AND THE LIKE.; James Brightmore, Tideswell, England. App. filed Oct. 16, 1907. A process of fixing the nitrogen of the air by taking lime or slag or other waste material and subjecting it to the action of an electric arc while in a moistened condition, and finally exposing the mass to nitrogenous sewage.

888,318. THIRD-RAIL INSULATOR; Lucien Henri Delloye, Paris, France. App. filed Oct. 5, 1905. A method of mounting insulating blocks formed of molded glass, whereby the insulating blocks are securely attached to the rail, but are capable of relative movement to permit expansion and contraction of the rail.

888,535. PRINTING TELEGRAPH; Charles L. Krum, Chicago, Ill. App. filed Aug. 22, 1903. A printing telegraph apparatus in which the messages transmitted are reproduced at the receiving station by being printed upon sheets of paper as in ordinary typewriter work. Complete construction of a magnet-operated type-bar machine, including all the electrical features and circuits for a special code having impulses of different strengths, and different polarities.

888,339. COLLECTOR OPERATING VALVE; George Macloskie, Schenectady, N. Y. App. filed July 28, 1906. A current collecting apparatus for electric vehicles having a casing with a piston and a slide valve, and means for normally maintaining balanced pressure on opposite sides of said piston. Has hand-operated means for relieving the pressure on either side of the piston, according to the direction it is desired to move the valve.

888,340. ELECTRIC BELL RINGER; George Macloskie, Schenectady, N. Y. App. filed Dec. 4, 1906. A device for swinging the usual clapper bell of a locomotive by a solenoid magnet. Makes use of a form of solenoid vibrator having a link connection with the bell and operated by a switch in the engine cab.

888,341. VISUAL SIGNAL; Wilbur L. Merrill, Schenectady, N. Y. App. filed July 21, 1906. A visual signal designed to change its appearance from all sides when operated, presenting a uniform color in all directions at any given time. Designed for use on ships in giving signaling orders. Has a series of vanes which are simultaneously displaced around a drum by means of an electromagnet.

888,349. COMBINED CABLE SUPPORT AND WIRE CLIP; Frederic D. Ogden, Bayonne, N. J. App. filed Sept. 14, 1907. A hanger comprising a sheet metal strap which surrounds the cable and is locked in such relation by a fastening screw which also has an eye to receive the messenger wire.

888,355. FUSE; Ernest Schattner, Schenectady, N. Y. App. filed June 10, 1905. A fuse wire extends through a slot of an insulating barrier disk, said slot flaring in both directions. Has absorbent material surrounding the fuse wire and divided by said barrier.

888,362. MONOCYCLIC SYSTEM OF ELECTRIC DISTRIBUTION; Charles P. Steinmetz, Schenectady, N. Y. App. filed March 30, 1895. A means for so reconstructing existing alternating-current plants of the single-phase type that they may be adapted, at a minimum expense and with the greatest utilization of their existing structure, to the generation of monocyclic currents.

888,376. EXTENSIBLE CHANDELIER; Walter I. Wilson, Los Angeles, Cal. App. filed March 1, 1907. The chandelier has a pair of telescoping tubes within which are a pair of spirally coiled conductors which are extensible to accommodate the varying lengths of the chandelier by an ordinary spring-coil action.

888,378. ADAPTER FOR INCANDESCENT LAMP SOCKETS; Montraville M. Wood, Schenectady, N. Y. App. filed Nov. 15, 1904. An adapter by which a miniature electric lamp may be used with an ordinary Edison socket. Has a porcelain block with an exterior threaded shell of standard size, and a pair of interior threaded shells to accommodate different sizes of miniature lamps.

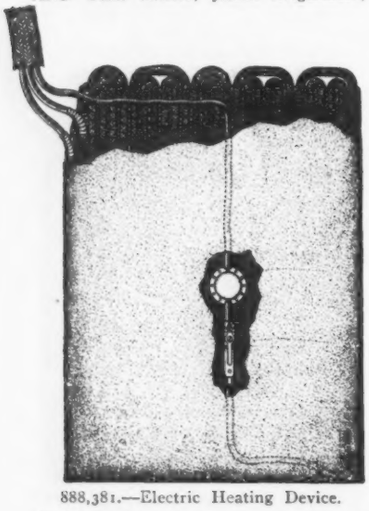
888,381. ELECTRIC HEATING DEVICE; William S. Andrews and Henry J. Mauger, Schenectady, N. Y. App. filed Sept. 18, 1907. A cut-out for an electric heater comprising spring contact strips arranged in open position and normally sprung to a closed position and sealed by a fusible metal.

888,382. SLIDING CURRENT COLLECTOR; Albert H. Armstrong, Schenectady, N. Y. App. filed Aug. 6, 1906. In place of a trolley wheel, the patentee has a horizontally supported plate with hooked extremities. In order to avoid cutting deep grooves or ruts in the conductor, it is made with a plurality of logitudinally adjustable adjacent bars which can be set to new positions from time to time.

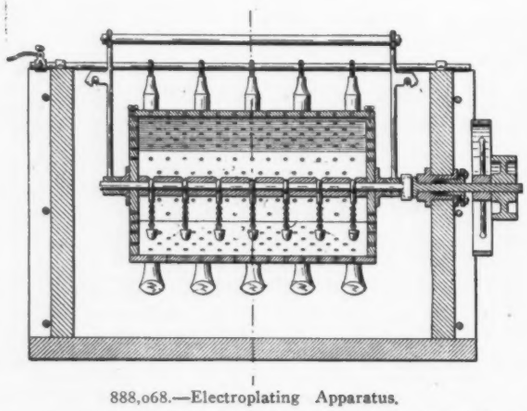
888,389. ELECTRICALLY OPERATED TRACK SWITCH; Fred B. Corey, Schenectady, N. Y. App. filed Dec. 7, 1906. The switch point has a connection with a core of a double solenoid magnet, the sections of which are selectively energized by a relay. Is of the type designed to be thrown in one direction if the car is drawing current, and in the other direction if the car is not drawing current when passing an insulated trolley section.

888,392. BALANCER SET; Richard W. Douglas, Lynn, Mass. App. filed Oct. 1, 1904. An arrangement of the shunt fields and parts allied therewith whereby an increased flexibility of the machine voltages is secured, together with certain other advantages.

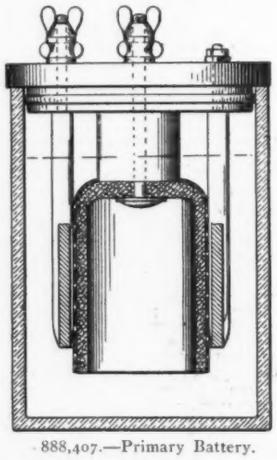
888,407. PRIMARY BATTERY; Charles B. Schoenmehl, Waterbury, Conn. App. filed July 21, 1906. A battery designed to obtain a minimum amount of internal resistance, but in which an internal short circuit is impossible. Designed to constitute a convenient primary battery for automobiles, and the like.



888,381.—Electric Heating Device.



888,068.—Electroplating Apparatus.



888,407.—Primary Battery.

888,416. CONTROLLING DEVICE FOR CARS; Theodore Bodde, Westfield, N. J. App. filed March 18, 1907. A means for controlling and stopping a vehicle, car or train. Has a track magnet, and a train magnet carried by the car or train moving along the track, and a safety device operated when the train magnet reaches the track magnet when the latter is in open circuit.

888,417. AUTOMATIC CONTROLLING DEVICE FOR CARS; Theodore Bodde, Westfield, N. J. App. filed July 10, 1907. Relates to modifications of the above.

888,418. TROLLEY CATCHER; Willis C. Burdon, Louisville, Ky. App. filed Sept. 21, 1906. A form of trolley retriever having a spring-impelled reel normally restrained by a ratchet and detent. The detent is released by a too rapid paying out movement of the trolley cord.

888,427. TELEPHONE SYSTEM; Carl W. Sharer, Philadelphia, Pa. App. filed June 13, 1906. In a telephone trunking system, the combination with trunk ringing signals of a supervisory signal in the trunk circuit controlled by the hook contacts of the called subscriber's instrument.

888,447. CONTROLLING MEANS FOR ELECTRIC MOTORS; Harry Ward Leonard, Bronxville, N. Y. App. filed July 12, 1905. Relates to the automatic control of a motor by the movement of a device driven thereby, and to the variation of its speed and direction of rotation. Has automatic means for reversing the rotation of the motor while maintaining the connections of the motor armature circuit unchanged.